TECHNOLOGY DEPARTMENT

GRINDING and FINISHING

NOVEMBER · 1959

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DETROIT

JOB SHOP PRODUCTION — ANTI-FRICTION BEARINGS AT I.H.

Also In this Issue:

How and Why of Gaging—Part 4

Why Wheel Balancing?

A HITCHCOCK PUBLICATION

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WHEREVER ABRASIVE OPERATIONS ARE PERFORMED

GRINDING and FINISHING

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Subscription rates: $6.00 per year in U.S.A. $7.50 per year elsewhere.
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New CINCINNATI 210-6 *Centuramic*

makes it easier than ever before

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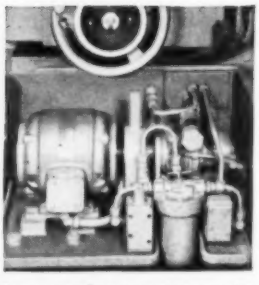
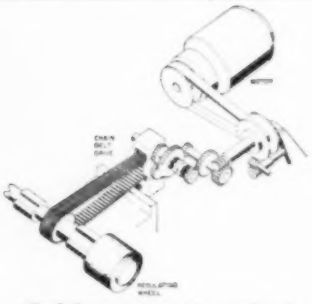


Low maintenance costs have been achieved in several ways . . . outside mounted hydraulic unit, for example.



Quicker setup is attained through infinitely variable regulating wheel speeds. Self-contained chain drive assures exceptionally smooth work rotation.

Cleaner working area for the operator. The cu ting fluid mist control unit (extra) prevents cutti fluid from splashing on the floor.

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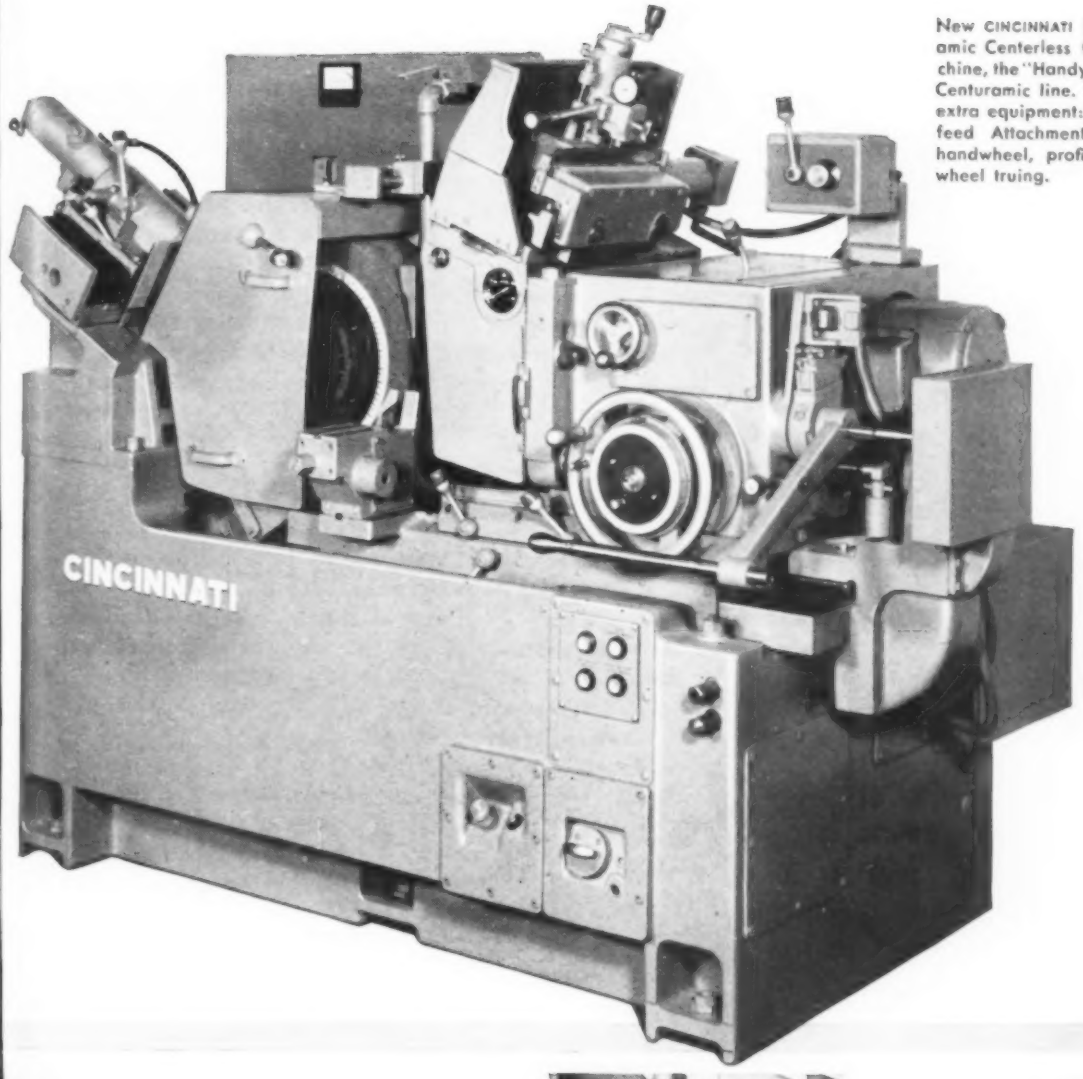
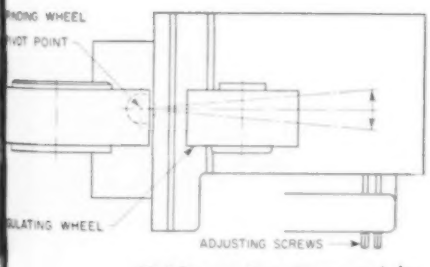
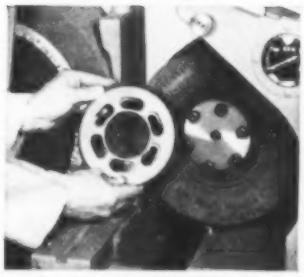


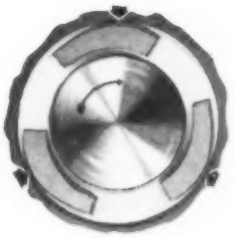
New CINCINNATI 210-6 Centuramic Centerless Grinding Machine, the "Handy Andy" of the Centuramic line. Cost-reducing extra equipment: Vari-Pitch Infeed Attachment, micrometer handwheel, profile regulating wheel truing.



Quicker setup is assured by virtue of Centuramic's swivel plate mounting of the regulating wheel housing. Both adjusting screws are located at the front of the bed.



Convenience and quicker setup are evident here. Simply loosen six screws, slip off the flange with a slight turn, and the regulating wheel is free to be removed.



Zero maintenance of grinding wheel spindle bearings has long been a CINCINNATI FILMATIC advantage. Centuramic, of course, incorporates this cost-reducing bearing.

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Editor's Mail

Standard Time Data

We are currently investigating various articles concerning Standard Data. Mr. Cyrol has had articles published concerning Standard Data on grinding in a number of your issues. Are reprints available covering their complete series? . . . Will you please inform me of availability and cost in order that I may place an order for their purchase. Thank you for any service that you may render.

Frank G. Varga
Staff Industrial Engineer
Mack Trucks, Inc.
Plainfield, N.J.

We are happy to send you reprints of Mr. Cyrol's articles. The price is 35 cents per copy.

We are also happy to report that due to the demand for this series of articles they are being updated and added to for a new series which will appear in the near future.

Roll Grinding

I would like to obtain a list of reprints that are available from your "Grinding and Finishing."

I am particularly interested in any article you may have on "Roll Grinding."

If such a list is available, I would appreciate your forwarding it to me.

C. N. Pearsall
Field Engineer
Norton Co.

We are sending both a list of reprints and articles on roll grinding.

Gaging

At the request of our Director of Quality Control, I should like to obtain three sets of the series of articles on "The How and Why of Gaging."

Since I do not know when the series will be complete, please keep this request on file until the series is complete.

Also I need two copies of the article "Finishes to Under One Microinch on Lathe."

Helen B. McCormick
The Warner & Swasey Co.

We will be happy to send you both articles in the quantities you have requested. The gaging series will be complete with this issue.

Techniques in Flat Polishing

We would greatly appreciate several reprints of the following article which appeared in your July issue of "Grinding and Finishing": "Techniques in Flat Polishing," by Thomas C. Smith.

J. I. Iding
M. P. Iding Disc Grinding Compound Co., Inc.

Reprints were not available, but, we were happy to send tear sheets of this article.

Safety

We are interested in obtaining the two articles listed in the **June** issue of the "National Safety News" and would greatly appreciate if you could send us a reprint or a tear sheet of each of the articles:
"The Case for 'Built-in-Guard' Cup Wheels"
"Right Face"

Claus Halberstaedter
Librarian
State of Washington
Dept. of Labor and Industries

You Should Know How It's Made

. . . The editorial in the issue which just arrived is very much to the point. I approve heartily.

O. L. Forchheimer
Trionics Corporation

Correction

Christopher H. Hill, Sr. has pointed out an unintentional transposition in the last two paragraphs of his article, **Truing a Diamond Wheel** (GRINDING and FINISHING, September, 1959, p. 57).

In truing a diamond wheel while it is still in the grinding machine, these paragraphs indicated that the truing wheel would run at about 6,000 sfpm while the diamond wheel runs at 200 sfpm.

These should be reversed. For this method the diamond wheel, in the machine, runs at 6,000-6,500 sfpm, while the truing wheel, on a toolpost grinder, runs at 200 sfpm.

The speeds shown in paragraph 3 are correct.

A 3M Case History Report

GRINDING PRODUCTION INCREASED 50% WITH "WETORDRY" BELTS

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OPERATIONAL DATA ON PREVIOUS METHOD: A competitive brand of abrasive belt was used for the same operation.

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OTHER 3M ABRASIVE PRODUCTS NOW IN USE: "Three-M-ite Resinite" Cloth Belts are used to finish aluminum trim bands; "Tri-M-ite" Cloth "PG" Wheel used to pre-polish dictating belt mandrel ends.

WANT MORE INFORMATION? Send for free manual, "3M Method of Belt Grinding and Finishing." Just write on your letterhead to 3M Co., St. Paul 6, Minn., Dept. AAH-119.

"Wetordry", "Tri-M-ite", "Resinite", and "Three-M-ite" are registered trademarks of 3M Co., St. Paul 6, Minn.
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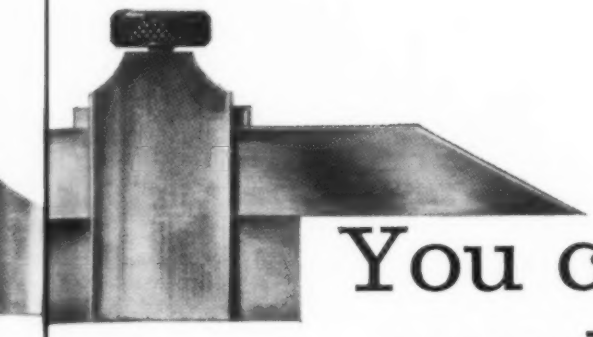

You can produce greater savings than you can buy

You can't recognize a value by its price alone. This is true of all types of grinding wheels and has special significance in diamond wheels in view of their high initial cost.

The price tag on a diamond grinding wheel may appear to be a good "buy," but the real consideration should be what will you get for your money?

Less expensive diamond grinding wheels than Norton wheels may save you money on immediate cost. But if the lower cost wheels do not perform their jobs efficiently or cause production delays because of poor quality or wheel misapplication — the price you paid is too much.

The only accurate measure of the value of any grinding wheel is how much it produces for you per dollar cost — not merely how much you paid for it. Here is why Norton diamond grinding wheels are worth more to you —

Norton Company introduced all three diamond wheel bond types, does all its own sizing and checking of diamonds — duplicating wheel specification with constant accuracy. Norton certifies the carat content, assuring full value for your money. Whether the diamonds you use in carbide grinding are mined or man-made, Norton gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field. And you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of one year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years' abrasive experience in addition to the specialized training. He is the most knowledgeable man in abrasives that you can consult. Make him your consulting abrasive engineer.

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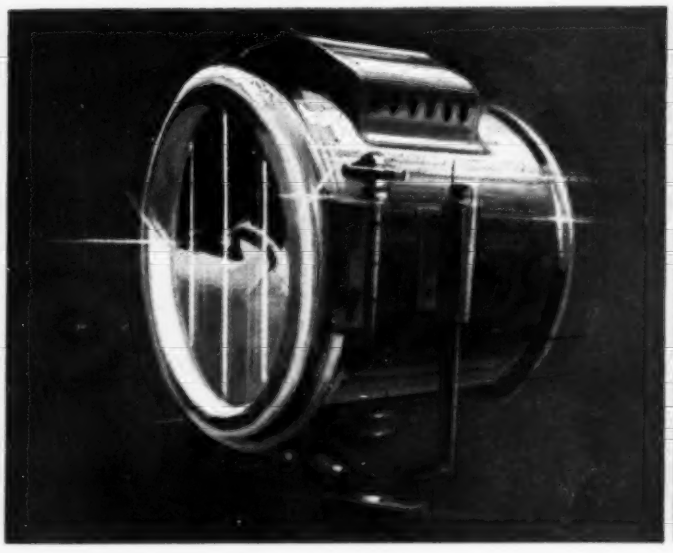

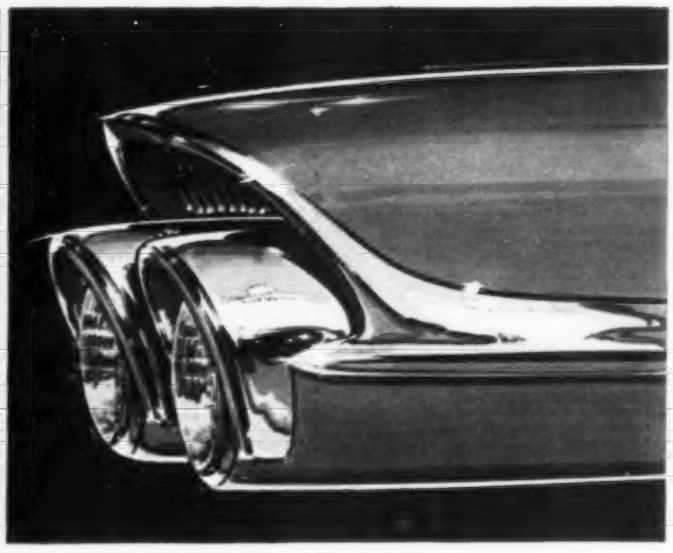

Even in 1910, part of an owner's pride in his car lay in gleaming brightwork. But polishing and buffing the shiny metal that he loved so well caused manufacturers plenty of headaches. And so they turned to Acme—and Acme has continued to supply the answers to their finishing problems.

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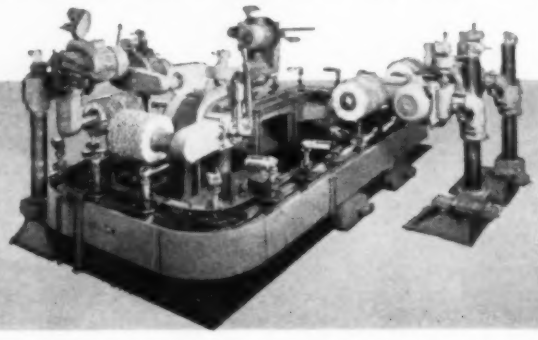

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WHEREVER ABRASIVE OPERATIONS ARE PERFORMED

Editor's Page

NOVEMBER 1959

Why Keep Paying?

Everything we buy has a price and everything we use involves an expense. The total expended for both the price of what we have bought and what we pay for the use is the cost. It should therefore be the total cost or expenses that are most important in any purchase we make. So many times we hear, "We can't afford the more expensive make or model."

The case in many of these situations is that they can not afford to buy the cheaper make or model because the total cost of buying the less expensive item will end up costing much more than the expensive one. In any purchase it is the total which can either be afforded or not.

This should not result in any one saying, "If that is the case, we had better not buy anything as it will cost too much." The facts are that many operations are right now costing you more than you can afford. This situation is very apparent if the equipment is in constant need of repair. Any time a trouble-maker comes on the scene it is time to look for a replacement. What about the rest of the equipment? Do you know how much it is costing you in relation to buying new equipment?

There are two formulas that have been developed and proven to be of value. They will both provide an indication of what it is costing you to use the equipment you now have. Many have been surprised to find that the operations they felt were beyond question were actually costing more than they could afford. A word of caution. No formula is better than the information which is used in it.

The best time to investigate your costs is now. European products are making definite inroads into U.S. markets today. Why wait until they have passed you to decide the changes which should be made. Gather **all** the facts, decide which are important and then use the formula. After you have done this, check your results. Why keep paying?

M. M. Patterson

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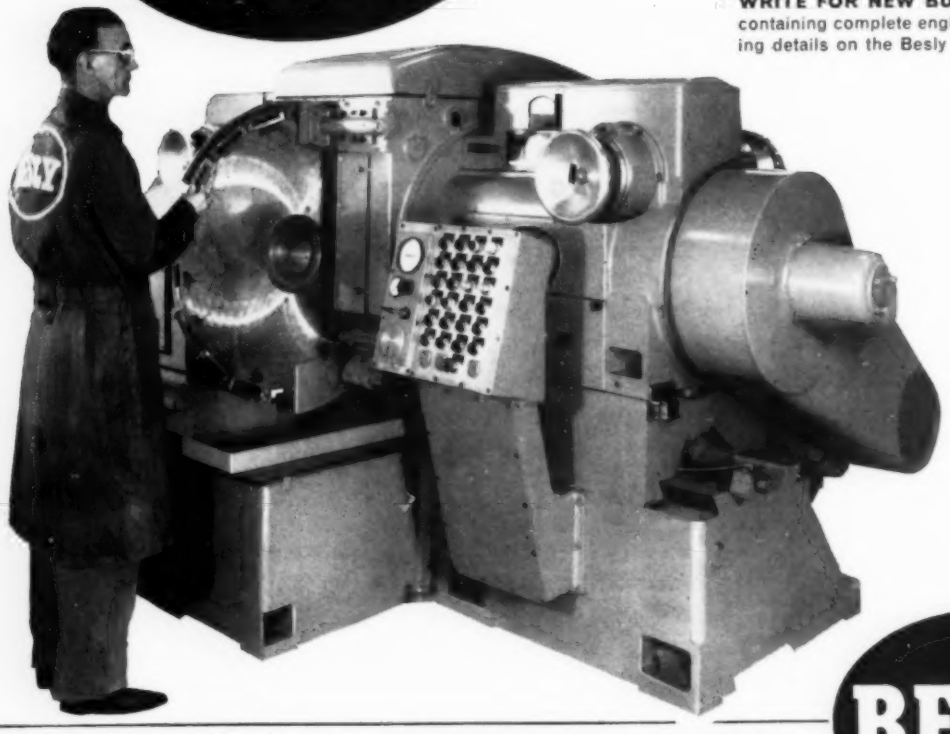

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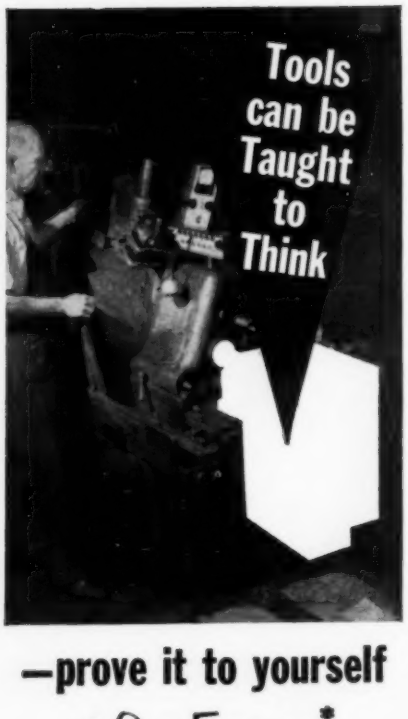

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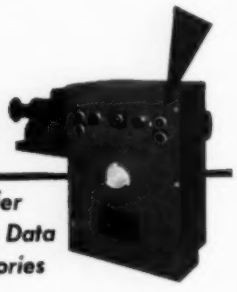

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Metalworking in General

Shown here in Van Norman's Automotive Training Center are Julio R. Salgueiro and John A. Janzen. Above (l to r) are Steve Szaban, Van Norman technical sales engineer; Mr. Salgueiro; Robert Kirchner, instructor in automotive machine shop practice from Ferris Institute, Big Rapids, Michigan; and Mr. Janzen.

U.S. Trained Auto Machinists Help Build Paraguay Roads

Paraguay's ambitious roadbuilding program will capitalize on the know-how gained in this country by two automotive machinists who have recently completed training at the Automotive Training Center of Van Norman Machine Company, Springfield, Mass.

The two, **John A. Janzen** and **Julio R. Salgueiro**, will soon return to their native Paraguay to direct operation and maintenance of heavy equipment used on the Trans-Chaco highway project.

Under the auspices of the Point Four Program and the U.S. Operations Mission to Paraguay, the men have visited several plants making heavy roadbuilding equipment. They have also been trained at other plants in addition to Van Norman.

Survey Highlights Need for Top Executives

Major industry needs more than 5,600 top executives within the next six months, according to the results of a recent survey of the nation's leading business corporations. The mailing went out to 1700 of the country's biggest companies, with a sample return of 8.95%.

Some of the conclusions of the project, announced by **William A. Hartan**, president of Executive Manpower Corporation of New York, are these:

Most of the positions (83.4%) are in the $10-$20,000 range to start. Only 1.4% begin above $40,000, while the rest fall between.

Slightly more than half of the positions are newly-created, and the rest are replacements.

During the past year, more than one-fourth of the executives placed at salaries above $15,000 had to be found

outside the company. This happened in spite of the fact that better than 60% of the respondents have internal management training programs and nearly 12% are planning to launch such a program.

Biggest demands are in manufacturing-production, engineering executives and sales executives, closely bunched, though engineers are believed to be most difficult to find. Sales ranked second in this respect, and manufacturing third.

Pontiac Offers Aluminum Wheels in 1960

Pontiac's adoption of aluminum wheels with integral hub and brake drum as optional equipment on its 1960 models marks a significant new development in the growing use of aluminum by the automotive industry, according to V. E. Flaherty, manager of automotive sales, Kaiser Aluminum & Chemical Sales, Inc.

Kelsey-Hayes will manufacture the wheels for Pontiac.

Rolls For Annealing Line

These rolls for a continuous steel strip annealing line are awaiting shipment from Blaw-Knox Co.'s National Alloy Division at Blawnox, Pa. Centrifugally cast of a 25 chrome—12 nickel type heat resistant alloy, the barrel sections of the rolls measure 18" in diameter and 55" wide. The roll face has been ground to a minimum finish of 32 microinches.

NMTBA Moves Headquarters to Washington

The National Machine Tool Builders' Association moved its headquarters from Cleveland to Washington last month, according to a recent announcement by **Ludlow King** executive vice president of the association.

The new quarters are located in a newly constructed three-story building at 2139 Wisconsin Avenue. The area occupied by the association, 7,500 square feet, was laid out to meet its specific requirements.

Some 180 machine tool building companies, producing approximately 90% of the nation's output of machine tools, are members of the group.

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PROFILE GRINDING
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COMING SR 3 SOON
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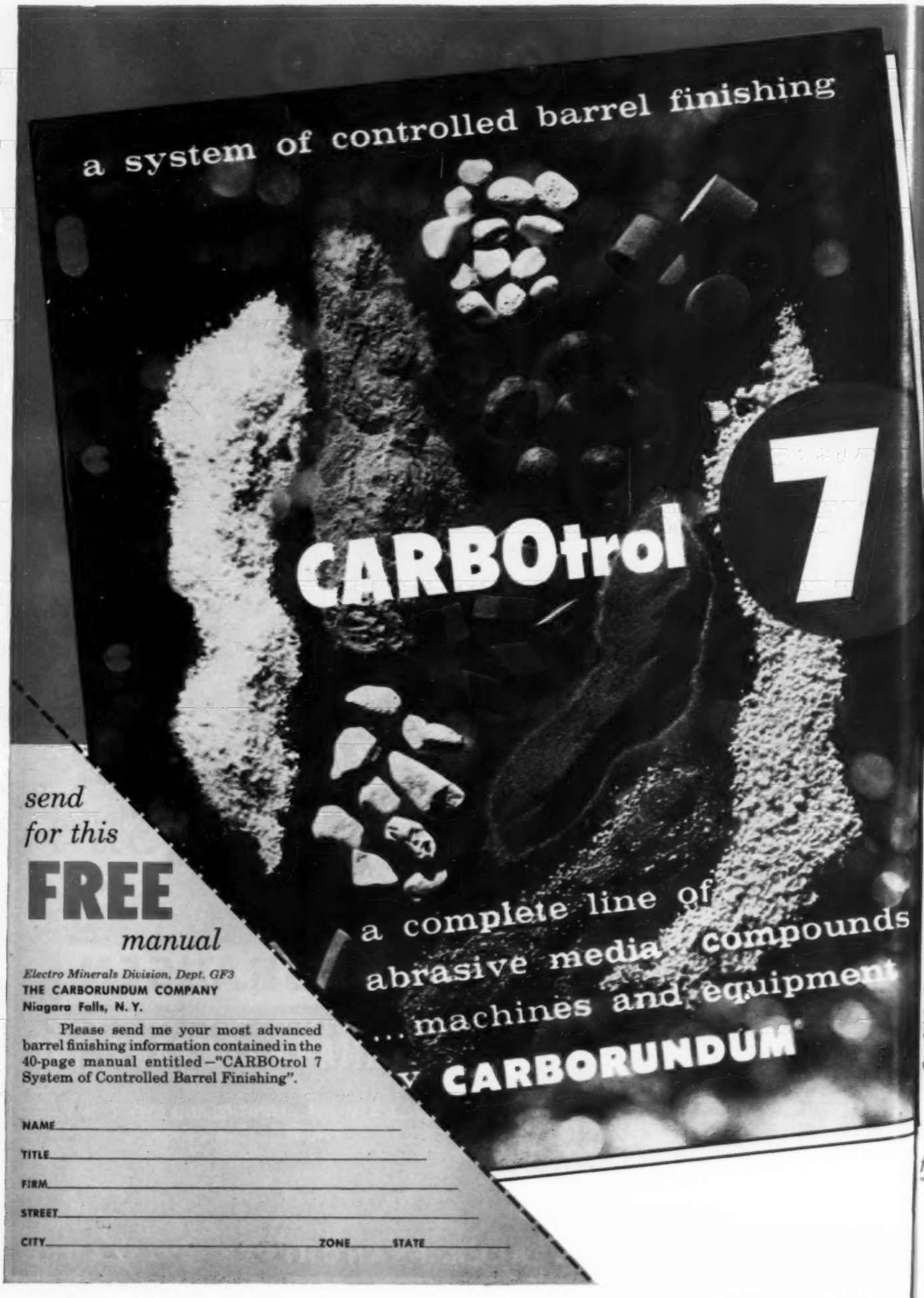
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CARBORUNDUM, a long established leader in abrasives, has now developed a new and exclusive method of controlled barrel finishing. Known as "CARBOtrol 7", this unique process assures low-cost metal finishing results.

In addition to a complete explanation of the "CARBOtrol 7" process, this manual includes comprehensive information on all types of abrasive media, barrel finishing compounds, and machines and equipment. Actual case history reports on a variety of applications, "do and dont's" of barrel finishing and a series of useful charts are also featured. These are but a few of the many interesting and instructive details of the "CARBOtrol 7" process contained in this manual.

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You'll be able to track down and arrest cleaning room costs . . . when you start using CINCINNATI (PD) WHEELS. That's because all (PD) * wheels (including the swing frame wheels shown above) are made by the remarkable CINCINNATI (PD) manufacturing process. Plus the fact that our trained and experienced grinding specialists are ready to assist you in quickly detecting the best grading for snagging operations.

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When you have the CINCINNATI (PD) WHEEL that gives you the lowest labor and wheel cost, you then can be sure that every reorder wheel will act and grind exactly like the original wheel. The CINCINNATI (PD) manufacturing process gives you Positive Duplication . . . time after time after time. Once your cleaning costs are cut, they *stay* cut . . . with CINCINNATI WHEELS.

CALL CINCINNATI

For the help of a CINCINNATI grinding specialist in working down those cleaning room costs, call your CINCINNATI (PD) GRINDING WHEELS distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

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GRINDING WHEELS

*Trade Mark Reg. U.S. Pat. Off.

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SAM SAFETY says:

No. 3 of a series • GRINDING and FINISHING • *A Hitchcock Publication 1959*

ray anderson

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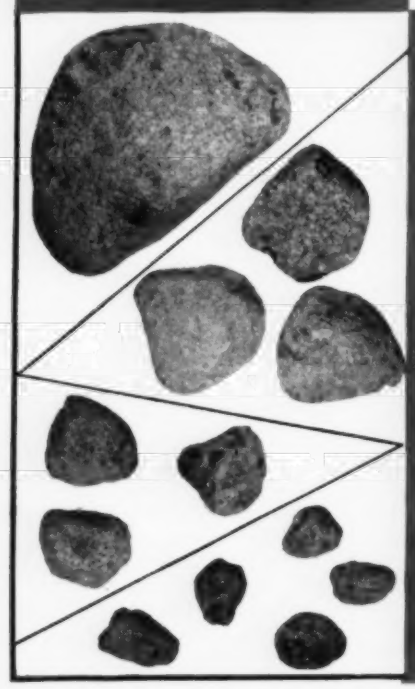
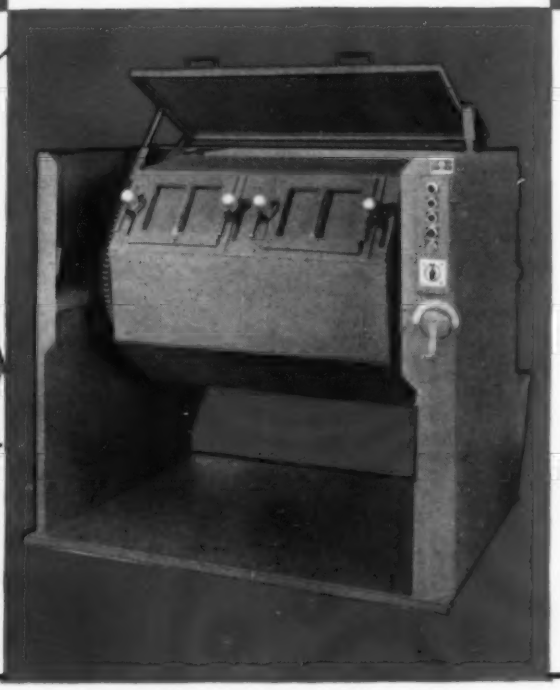


Exolon aluminum oxide tumbling abrasive is available in many sizes.



Double compartment barrel finishing machine. Manufactured by Roto-Finish Company

Parts of many sizes, shapes, materials can be barrel finished at lower cost.

There is an EXOLON Tumbling Abrasive for every job from heavy deburring to Micro Finishing

Successful Barrel Finishing of metals requires two things — the correct abrasive formula for the job and the best barrel finishing equipment available. Obviously one without the other is useless; and any compromise with either will give inferior results.

EXOLON Tumbling abrasives are produced from solid fused aluminum oxide made under carefully controlled conditions in electric arc furnaces. The individual shapes are carefully sized, hard, tough and abrasive — factors that contribute to speedy uniform finishing results.

If you are barrel finishing hard metals ... soft metals or just deburring, let us show you the results produced by EXOLON Tumbling Abrasives.

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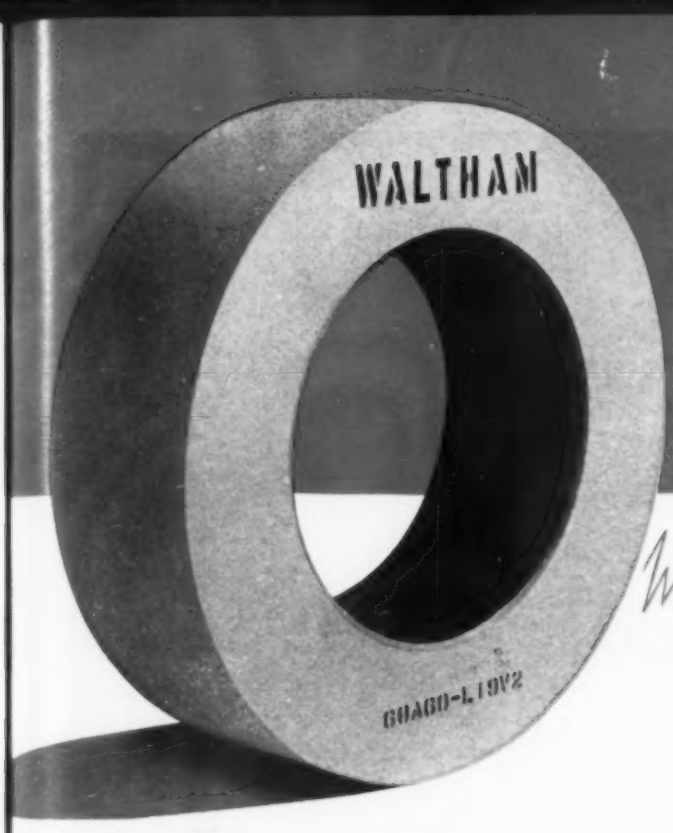

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CENTERLESS WHEELS

Help you make **every hour** on each centerless grinder

a high production — low cost hour

FOR THROUGH FEED

Extra production every hour
Every pass removes extra thousandths
Waltham wider grain spacing for more chip clearance
Structures 9, 8 and 7
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FOR IN-FEED

Extra production every hour
Each in-feed cycle in fewer seconds
Higher piece count before stopping to dress
Waltham V2—The pressure balanced bond preserves profile as the widely spaced, sharp abrasive rapidly completes the cycle.

Every order **SONIC TESTED** to insure wheel to wheel duplication

"STROBOCONN for Sonic Testing

Variable Density Delivers High Production all the way to the flanges

Every grinding wheel wears down—but Waltham **Variable Density** compensates for the gradually slower surface speed—the gradually smaller arc of contact—and gives uniform action all the way to the flanges.

Waltham Grinding Wheel Company · *Established 1880* WALTHAM, MASSACHUSETTS

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ABRASIVE CUTTING KNOW-HOW

ACCO for Better Values

With this Campbell Machine, you can--

Cut 6-inch Diameter Hard Alloys-Cleanly and Accurately-in Less Than 3 Minutes!

• This Campbell wet abrasive cutting machine—the Model 406—will cut tubing, bar stock, angle iron, or any other shape up to 6″ round or square—and it will cut practically *any* material, including the new super alloys and exotic metals. Like all Campbell machines, it's designed to give *accurate* cuts, quickly and cleanly.

HIGH SPEED—4 to 8 seconds per square inch is the normal cutting speed for all Campbell wet abrasive cutting machines. For instance, you can cut 6″ diameter hardened steel in less than 3 minutes.

ACCURACY—Campbell machines are production machine tools. They cut within close tolerances to reduce rejects and scrap loss. For example, the Model 406 will cut 3″ diameter material to lengths within ±.010″, 6″ diameter within ±.030″.

FINE FINISH—Additional finishing operations are rarely required. There is no burn, and burr has been reduced to an absolute minimum.

POWER OSCILLATION—On an oscillating-type machine such as the Model 406, the cutting wheel is moved horizontally back and forth *across* the cut as the wheel is fed downward. The result—greater cutting capacity, with longer wheel life.

PROPER COOLANT APPLICATION—Large reservoir and a 33 gallon/minute pump provide high volume of coolant. Unique Campbell distributor applies coolant equally to both sides of the wheel—an essential requirement for accurate cuts.

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Choose from four types of Campbell machines for wet or dry cutting—chop stroke, oscillating, horizontal or rotary—with capacities up to 14″ rounds, 12″ billets, plate up to 6″ thick and 20 ft. long.

Regardless of your application, you'll find that a Campbell machine provides you with the best cut-off method for modern production techniques—far more efficient, accurate and economical for cutting many materials than other cutting equipment.

WRITE FOR DETAILS—Bulletin DH-260 gives the complete story on the Campbell Model 406 abrasive cutting machine. We'll also be glad to send you information on other machines; just tell us your cut-off application. And remember—your Allison-Campbell Field Engineer is an abrasive cutting specialist. Call on him for expert advice.

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You Asked . . .

ARTHUR RAKESTRAW
Contributing Editor

Mounted Wheels vs. Coated Abrasive Cartridge Rolls

• Please comment on the relative advantages of mounted wheels and coated abrasive cartridge rolls for such applications as deburring.—D. C., Wheeling, W. Va.

We presume you have reference to the removal of sharp margins resulting from previous machining operations on both hard and soft materials.

Mounted wheels because of the wide selection of grades and grits might easily show better results in removing heavy burrs from steel parts, due to their resistance to grooving. Because of the grade selection, one has the opportunity to select wheels of varied wearing qualities and can somewhat control wheel life.

Abrasive rolls because of their comparative flexibility would be of particular advantage in burring soft metals, which have a tendency to load. The smooth abrasive action would permit a more desirable blending of radii.

The more wear-resistant mounted wheels might require frequent dressing to restore face shape or remove surface loading, while abrasive rolls are more or less self-dressing.

A Reader Comments on Segment Specs

In your July issue, (page 17), J. R. of Kalamazoo, Michigan, asked for the best segment for grinding cast iron.

We read with interest your answer to this question, and feel sure that you have given him a correct answer.

But what intrigues us is why you suggest dressing segments, because we have always found that if a segment is of correct grade, it is self-dressing. The roughing operation opens the grinding face, and when you come to finish, the segment is in suitable condition for taking very fine cuts at very slow traverse speeds so as to give a high finish without glazing or burning.

The other point which comes to mind is that in Great Britain we consider vitrified segments to be out of date, although they are still supplied by some manufacturers, and we wonder what progress has been made in the States by resinoid segments as compared with the vitrified product.

We have been producing large quantities of resinoid segments for many years. Their quality is now very high, and we are able to duplicate quite easily from one batch to another.

It also seems odd to us that in the U.S.A., we understand, that most disc grinders are fitted with resinoid or oxychloride discs in preference to vitrified, although double disc grinders generally take the place of segmental or ring wheel grinders, and it does not seem consistent to us to fit vitrified segments to surface grinders and resinoid discs to disc grinders.

R. A. Bingley
Technical Director
Abrafract, Ltd.

. . . And the Reply

Your comments regarding the rather extensive use of segments of a grade that might be termed self-dressing were most interesting. No doubt there are many surface grinding operations in this country which make use of this type of product. However, it has been our observation that these would be much too costly on what might be considered high-production jobs.

There is no feasible way of comparing actual production jobs in our two countries. It is quite possible that a much higher rate of production precludes any possibility of using segments specifications whose rate of wear cannot be controlled.

Segments of the specifications commonly used on high-production jobs do not wear fast enough to eliminate surface loading. Truing of the segment prior to the finishing cuts removed loading and dull abrasive, thus presenting a sharp, free-cutting segment face for the finishing cut.

There are many installations of surface grinding where the resinoid segment has always been standard. Whether or not the vitrified type is being replaced by the resinoid to any great extent, or at all, is questionable. It would require a survey of all of the abrasive manufacturers to establish this fact. Any increase in resinoid segment manufacture would not necessarily indicate that it was accomplished at the expense of vitrified.

In the Central States, no such replacement appears to have taken place. The vitrified type segment is still more extensively used on high-production surface grinding jobs than resinoid.

When disc grinders first made their appearance they were equipped with comparatively thin discs. There was no economical method to manufacture the vitrified type and provide the perforations and the mounting lugs necessary to mount the discs to the plate. Resinoid was ideally suited because of the comparative ease of molding and the low baking temperature.

As disc grinding became more popular and thicker discs for longer life

between disc mountings became more popular, the original bond types simply went along with the change.

Although vitrified discs have been available for a long time and many of the manufacturing difficulties have been overcome, the grinding action of the resinoid specification is difficult to duplicate with vitrified.

Although many parts now ground on disc grinders were formerly processed over other types of surface grinders, the actual grinding process is somewhat different. Considerably more heat is generated with the two opposite surfaces being ground at one time.

This heat must be dissipated in the coolant stream and reduced in its intensity by the introduction of perforations of various sizes and patterns.

Due to the nature of the operation, specifications similar to the self-dressing type are particularly well adapted.

We believe that resinoid and oxychloride bonded wheels are more extensively used on disc grinding operations because the bond characteristics and the resulting grinding action have not been satisfactorily duplicated by the vitrified product for this type of work.

It is quite possible that such a replacement may eventually take place on many grinding operations. There has been a gradual increase in the use of resinoid wheels on such operations as roll grinding, cylindrical and centerless through-feed, where normal wheel wear can easily be compensated for by additional infeed of the wheel, without loss of production due to wheel truing.

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Anti-Rust Solutions

● Immediately after our parts are finish ground we dip them into an anti-rust solution which works until parts are assembled. Because of handling parts in assembly this solution must be removed and salt from hands rusts the parts. Have you any remedy for this condition?—K. B., Rockford, Ill.

We have observed the method of handling lapped and finely ground parts in a number of manufacturing concerns. Clean cotton or rubber gloves are worn by all persons handling such parts.

Though we are not familiar with your product, it is assumed that any oil film is not permissible in the part after assembly. Otherwise we would have suggested that you dip or spray the parts with a protective coating of fine oil after the anti-rust solution was removed.

Importance of Wheel Balancing

● How important is wheel balancing to wheel life, finish and spindle bearings, both in roughing and finishing on thru-feed centerless grinding on tool and die steels?—J. H., Latrobe, Pa.

Regardless of the type of grinder on which the abrasive wheel is used, or the type of finish required, the abrasive wheel should be balanced as nearly perfectly as the equipment will permit.

If a wheel is noticeably out of balance, it is impossible to true its periphery correctly. Theoretically, such a wheel will grind only on one half of its periphery. It might easily produce chatter marks deep enough in a rough-ground surface to preclude any possiblity of their removal in the finish grinding operation.

Wheel life would be reduced because of more frequent wheel dressings in an attempt to produce the desired finish.

Continued use of wheels badly out of balance will result in excessive bearing wear and eventual failure.

Design for Grinding

RICHARD L. McKEE • Associate Editor

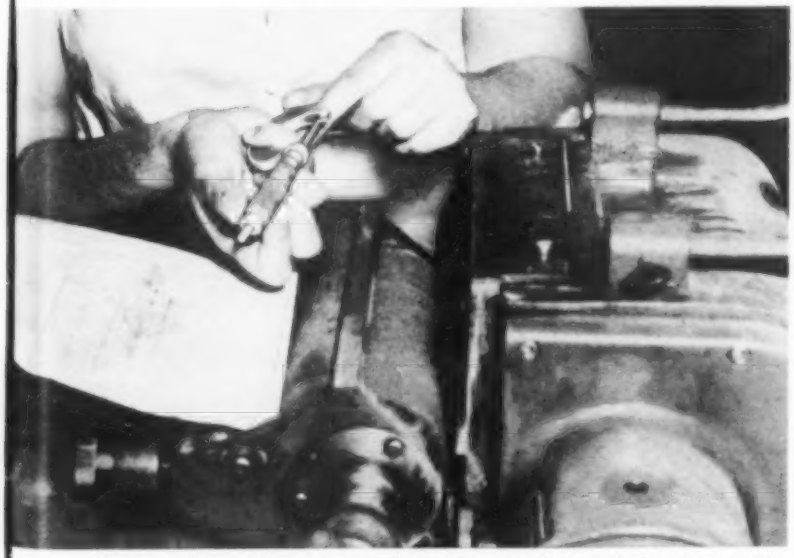
Crush Grinding for Forming Plastic Cylinders, Tubes

For high-volume, close-tolerance jobs, cuts time as much as 20% over screw machine or lathe, eliminates burrs, holds tolerances of .0005″ or tighter.

● Crush form grinding for making small cylindrical parts from laminated plastic or vulcanized fibre not only saves time, but is also the only possible method in many instances, according to the Taylor Fibre Co.

This adaptation of conventional centerless grinding not only does the job as much as 20 per cent faster than screw machine or lathe production, but also is often the difference between meeting or missing tolerance requirements.

It has the added advantage of leaving no burrs, eliminating a separate operation.



With a set-up like this specialized centerless grinder for crush-form grinding, small cylindrical parts up to 8″ long and 1½″ in diameter can be formed from laminated plastic or vulcanized fibre stock to tolerances as close as 0.0005″ or tighter, and at rates up to 20% faster than by conventional methods.

Capable of producing any part which can be made on a lathe with forming tools, crush form grinding is recommended where:

- Finish tolerances are ± .0005″ or tighter (normal screw machine or lathe tolerance is ± .002″).
- Volume is large enough——generally 300,000 pieces and upward—to justify initial cost of wheels.
- Lathe bits might cause de-lamination of laminated plastic.

In the process, a series of grooves, bevels or other configurations are cut into the work wheel surface for the specific part being formed. As many as 25 or 30 small parts can be made at a time from a single piece of feed stock, at rates of up to 5 or 6 cycles per minute. Wheels are capable of long runs with little wear, depending on the material of the piece-parts. Redressing the grinding wheels is not difficult.

Breakage which sometimes occurs on long, thin pieces with lathes or screw machines is minimized, since both the work wheel and the backup wheel support the work.

A recent case illustrates the value of the technique. The part required was a firing pin .225″ in length, .064″ in width, with tolerances of —.0005″, with no burrs permitted. Requiring a 15 degree taper at either end, to .020″ depth, these parts could not have been made by any other production method and still have met required tolerances.

The material ground for the firing pins is a laminated plastic of very fine weave, light weight cotton fabric with phenolic resin content, which offers good tensile, impact and impact fatigue strength.

The work wheel used is 100 grit vitrified silicon carbide, L grade, 11 structure. The back-up wheel is 60 grit vitrified aluminum oxide, R grade, 10 structure.

• • •

How Ralph Hockett increased diamond wheel life 72%

If ever a man was a perfectionist, that man is Glenn Carr, General Foreman of the Tool Grinding Department at the Wichita Division of the Boeing Airplane Company. And, after fifteen years of working to the kind of tolerances required by the world's leading builder of superbombers, he tends to be skeptical of miraculous claims.

That's why Ralph Hockett of Bay State distributor Wichita Pump & Supply Co., didn't make much fuss about Bay State's new diamond wheels. He analyzed the problem in his usual fact-finding manner, submitted wheels for test and let them speak for themselves.

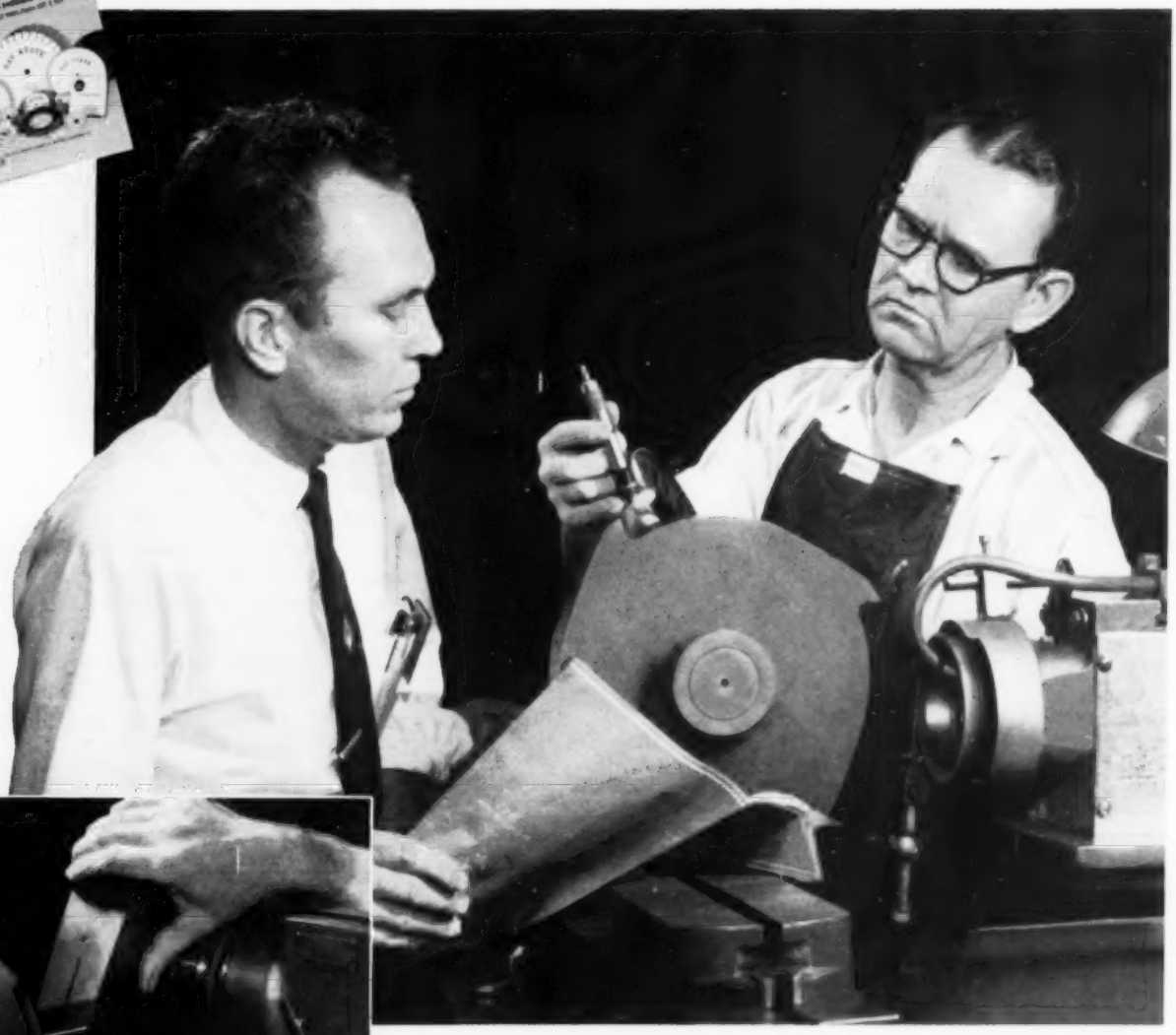
The result was an eye-opener. The pay-off was in wheel life. Against an average life of *125* hours previously, the new Bay State wheels averaged *215* hours per wheel!

One important factor contributing to this bonus wheel life was the use of Bay State's unique BA Resinoid bond.

The Bay State wheels were not only longer-lasting but they were more versatile, cooler cutting and gave a far superior finish. They are now, of course, a regular inventory item at Boeing, Wichita, where B-52 missile bombers are in production for the Air Force.

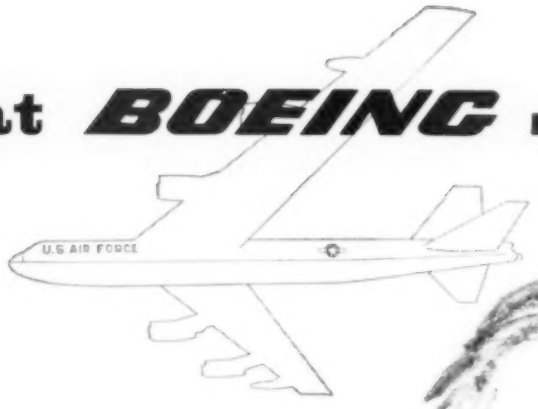
If you have a diamond-wheel grinding problem, you'll find that your Bay State representative, direct or distributor, is ready to supply the right wheel for the job with either natural or man-made diamond abrasive ... and he may well be able to give you a significant improvement in performance, too. Better grinding at lower cost ... that is his business.

This new catalog, which includes pricing data, gladly sent on your request. Ask for Form 217.



Operator Harvey Johnson checks the finish on carbide-inserted tooth of a milling cutter after grinding with Bay State's 215-hour (average life) diamond cup wheel. Glenn Carr, General Foreman, checks Johnson's reading against blueprint.

at **BOEING** WICHITA



You don't get to know the aircraft business overnight and Ralph Hockett is the first to admit that he has never stopped learning. 27 years as an abrasive specialist, with 19 of them servicing Boeing on everything from the early B-17s on up, have given him what you might call a substantial background in the industry.

BAY STATE ABRASIVES

BAY STATE WHEELS of PROGRESS

Bay State Abrasive Products Co., Westboro, Massachusetts.
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the abrasive wheel with the characteristics you want

SIMONDS CUT-OFF WHEELS

For cutting metals *and* costs, use these abrasive wheels. They are just about the quickest, most efficient way to cut all kinds of metal and non-metals, and, since Simonds makes them in all grain, grade and bond combinations, you are sure of getting the ones exactly suited to *your* needs.

Regular Resinoid bonded for the rigors of high speed operation. Borolon (aluminum oxide abrasive) for steel bars, tubes, angles, etc. Electrolon (silicon carbide) for cast iron, bronze, brass and non-metals.

Reinforced Resinoid bonded for added strength. Double XX wheels have the same fast action of ordinary resinoid bonded wheels, plus the extra strength of glass fiber reinforcement on both sides. For metals and non-metals, including all building materials except wood.

Regular Rubber bonded for wet or dry grinding. Ideal for cutting all materials under stress and strain. Because of their clean-cutting action, finishing operations can be eliminated.

Reinforced Rubber bonded for extra safety. For swing-frame cutting on gates, risers, etc. Available with (1) Standard Reinforcement; fiber glass on both sides (2) Double Reinforcement; reinforced internally in addition to both sides, or (3) Triple Reinforcement; two internal reinforcements in addition to both sides.

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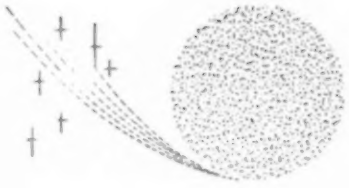
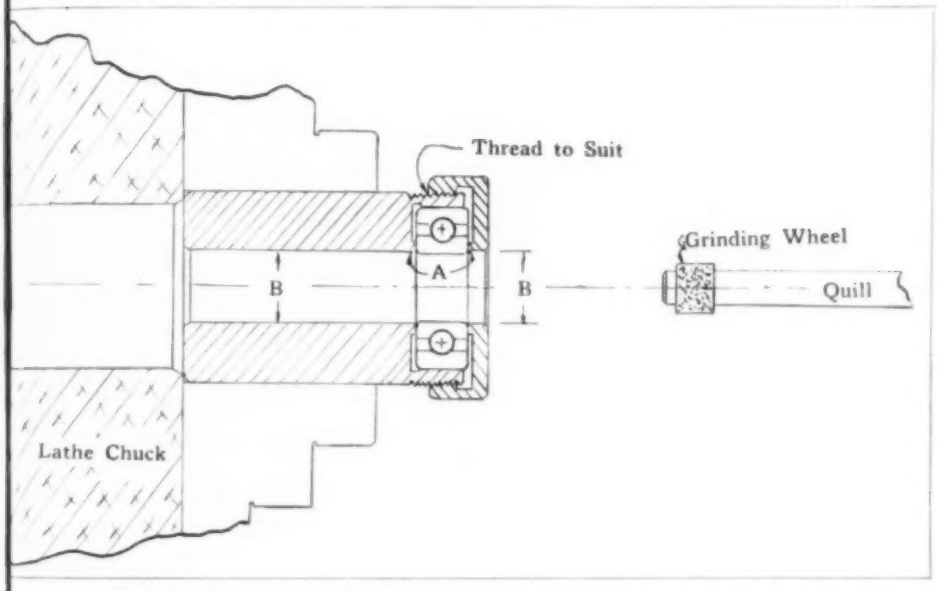


Ideas from the Shop



Sketch of fixture for enlarging the I.D. of a ball or roller bearing.

FIXTURE FOR HOLDING BEARINGS TO ENLARGE I.D.

By Homer R. Zeller

• Occasionally the need arises for a ball or roller bearing of a size not readily available from stock.

The use of a simple fixture to be held in the chuck of a lathe with a tool post grinder easily overcomes this problem.

It will be noted from the illustration that the inner race of the bearing is held tight by projecting points "A" on the I.D. of the cap and the barrel of the fixture, while the concentricity of the bearing is maintained.

Diameters "B" of the fixture should be slightly larger than the finish size of the bearing I.D. The bore of the fixture should be a slip fit for the O.D. of the bearing.

Points "A" protect the balls or rollers from abrasive dust during the grinding, and if the dust is blown or brushed out before the outer cap is removed, there will be no harm from this source.

This fixture also works exceptionally well for holding bearings to be lapped to very close tolerances.

REGRINDING REAMERS WITHOUT CENTERS

By H. Landauer

• Sometimes a reamer without a center-hole must be ground down to a smaller size, or ground at the chamfer or lead-taper. The center hole may be missing because the reamer originally had a pilot which has been cut off, or because it had center-cutting teeth which became obsolete when the production job for which the reamer was made was completed.

In the past we ground a male taper to the cutting end and held it in a female center, both on the cylindrical grinder and the tool-and-cutter grinder.

Now we find it more convenient and simple to braze a small, flat disk, the size of a washer, to the end, center-drill it with the reamer held in an accurate taper-spindle or chuck on a good lathe.

Then the reamer can be re-ground in the conventional way, on male centers.

The moderate brazing heat required does not affect the temper of HS tool steel. The disk can be removed after grinding in case the reamer's front teeth will be used again.

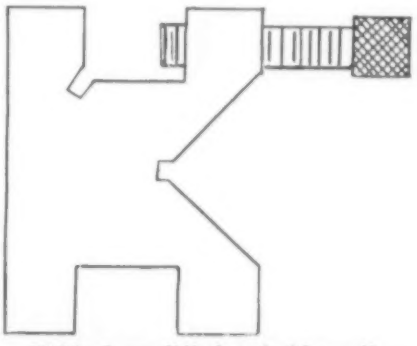
HOLDER FOR SMALL PARTS ON SURFACE GRINDER

By Chas. A. Gable

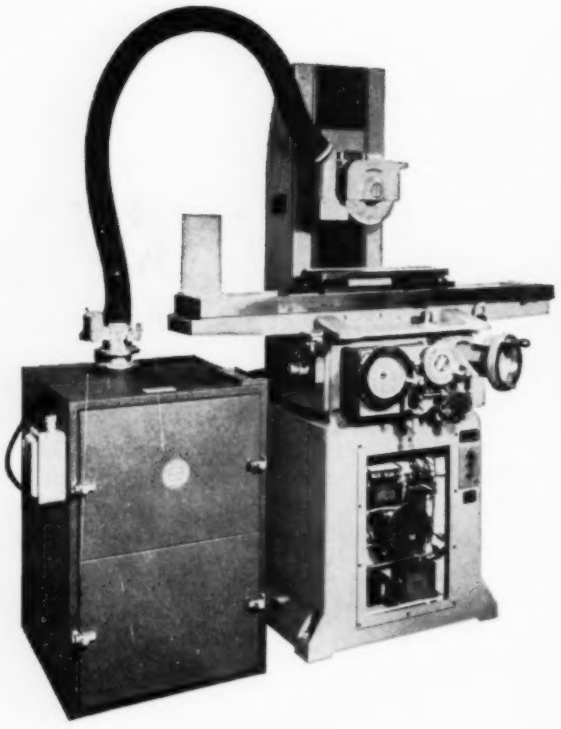
• There is always a need for a square holding device for grinding small parts on a surface grinder.

Such a device can be easily made by squaring the opened portion of a precision V-block, as illustrated below.

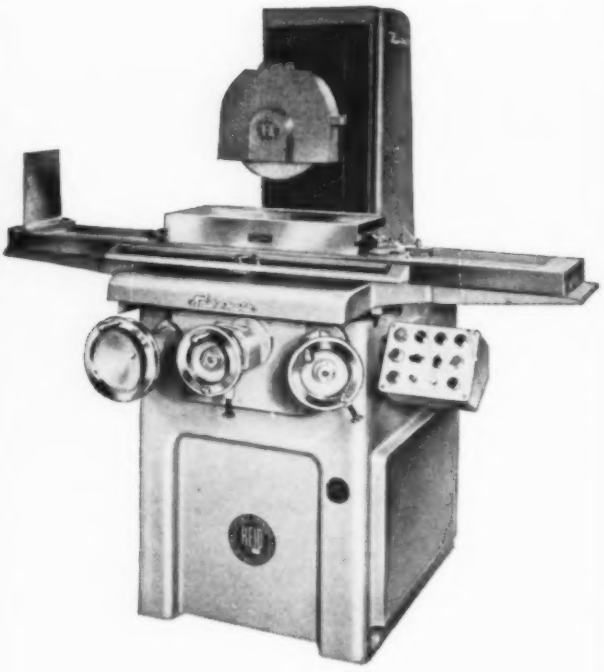
After the sides and bottom of the opening have been ground square to each other, small pieces can be held with the screw that comes with the clamping bar on the V-block.



V-block modified to hold small parts on surface grinder.



MODEL 618 P
with dust collector



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The vast number of REID *precision* surface grinders, in all kinds of industry, is the best proof of their outstanding quality.

In the 618 class these different models are available; a 618 P with power operated table and cross feed — a 618 PT with power table and hand operated cross feed — and a completely manual grinder, the 618 H. Automatic lubrication and a Cross Slide Lock are included on REID grinders as standard equipment.

The REID-O-MATIC is a fully automatic, all electric, surface grinder with a capacity 8″ wide, 24″ long and 21″ from the table to the center of the spindle.

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"U.S." Grinding Wheels installed on Naxos-Union roll grinder.

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After Alex Munroe of Revere's Baltimore plant installed "U.S." Grinding Wheels on their Naxos-Union roll grinders (for reconditioning rolls on their Sendzimir 51" rolling mill) several things were immediately apparent. Chatter was eliminated and stock removal was clean and efficient. Grinding time was cut approximately 30% while producing a regular finish.

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The Day Maximation Began

In seeking ways to increase efficiency, production men in the metalworking industry have found elimination of hidden machine tool costs through the use of proper filtration equipment a virtual guarantee of maximum output and economy. This method of obtaining increased production rates is known as *maximation*. Although today, it is one of the most significant factors in determining metalworking profit ratios, the maximation theory and its initial applications were actually developed more than 20 years ago.

HOW MAXIMATION STARTED

A number of months after inspection and delivery of several thousand piston rings to an airplane engine plant, the manufacturer was told that the rings were unsatisfactory and would be returned. Metal particles in the coolant apparently had adhered to the rings during the lapping process and the original high polish finish on the inside of the rings was pitted and chipped on removal from storage. About this time, engineers from the U. S. Hoffman Machinery Corp. were pioneering in research and development of dry cleaning principles for the removal of metal from kerosene coolants. Asked to provide a solution to the problem, they designed a pressure filter system for the clarification of coolants.

THEN AND NOW

This first filtration equipment by Hoffman was a fantastic complex of pipes and valves. But it did a fine job of bringing clean coolant to the work. A few months later, Fafnir Bearing asked for 2 pressure filters "just like the original." From these pioneering concepts have come Hoffman's modern equipment. Today, Fafnir Bearing employs more than a dozen advanced Hoffman individual and central filtration systems.

At Fafnir and in thousands of other plants employing filtration, coolants and lubricants once contaminated by metallic chips, abrasives and other extraneous dirt are no longer responsible for high production, maintenance and costs, as well as premature obsolesence. Through proper filtration, machines originally designed and tested for peak efficiency with clean lubricating oil and clean coolants can now operate at or near rated capacity. Filtration has made it possible to obtain a 30 to 50% savings in grinding wheels, honing stones, broaches, cutting and other edge tools in addition to providing numerous collateral benefits and advantages.

TYPES OF FILTRATION EQUIPMENT

In making recommendations for solving filtration problems, Hoffman engineers draw on a complete line of equipment which includes;

PRESSURE FILTERS—This type of filter gives up to 100% clarity and is widely used with grinding, cutting and honing oils as well as water soluble oil coolants where finest clarity is consistently required. Easily adapted for large groups of machines. Unlimited coolant capacity.

FLOTATION EQUIPMENT—Automatic flotation units increase the productivity of machine tools and eliminate down time for sump cleaning. Provide excellent results in steel and cast iron applications with efficiencies of over 98% in one pass. Handles flow rates from 40 to 1500 gpm.

MAGNAFLOW SEPARATORS—Fully automatic and self-cleaning, Hoffman Magnaflo Separators remove from 75% to 90% ferrous solids from cutting oils and water soluble coolants. Flow rate from 40 to 1,000 gpm.

VACU-MATIC FILTERS — For continuous filtering of coolants from *individual* machine tools. Provides unusually high flow rates in continuous filtration of water soluble coolants. Completely automatic and self cleaning. Flow rates range from 40 to 2,500 gpm.

DISC FILTERS — Filter oils containing finely divided particles. Geared for continuous flow.

SUCTION FILTERS—Provide fine filtration on small flow rates for lapping, microhoning, grinding and similar operations. Cap.5-60 gpm.

SUMMING UP

Proper filtration delivering clean coolant makes it possible to achieve maximation with these savings.

- Greatly reduced down time
- Higher speeds
- Improved finishes—fewer rejects
- Longer useful life of coolants
- Life of edge tools extended
- More sustained tolerances
- Fewer stoppages, adjustments
- Scrap loss considerably reduced
- Elimination of motor pumps
- Curtails bacteria and rancidity
- Saves 25 to 50% in grinding wheels, honing stones, broaches, individual machine tools.

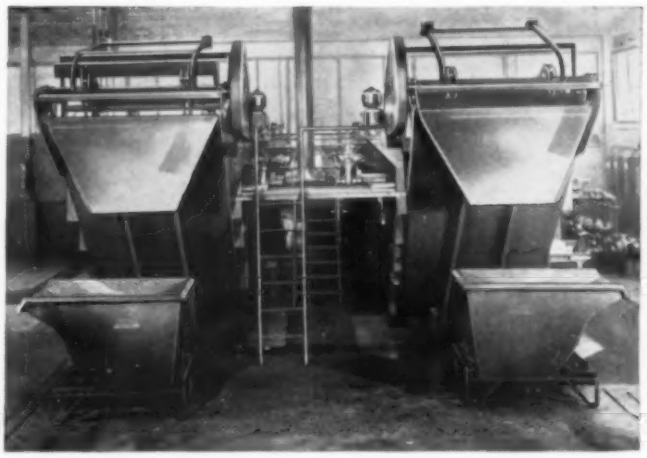
To check on the unlimited industrial applications of individual tool and complete central filtration systems, send for free bulletins and case histories on equipment described above.

Please write:
U.S. Hoffman Machinery Corp.
Dept. LR, Industrial Filtration Div.
Thompson Road—Plant #1
Syracuse, New York

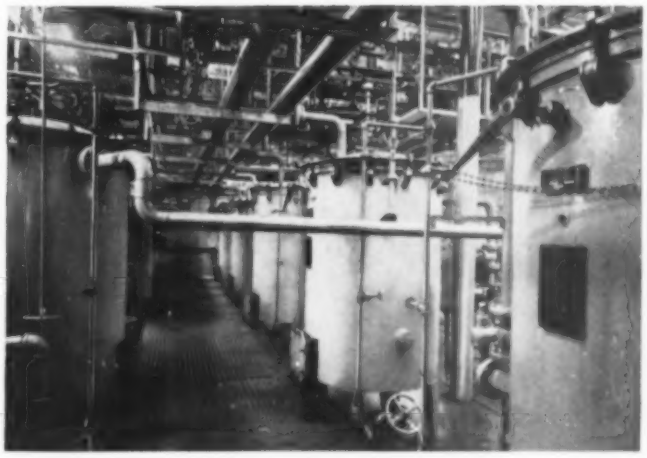
View of a central pressure filter system at the Plymouth Mound Road Engine Plant of the Chrysler Corp. This system serves a wet grinding department.

Today's high production costs dictate a good hard look at metalworking tools and techniques—make a reduction in operating expenditures essential to increased profit margins. Here are typical examples of companies which have obtained maximum production from machine tools by eliminating unnecessary and often hidden expenses through the use of Hoffman filtration equipment.

They're Beating High Machine Tool Costs and Obsolesence



A Hoffman Central Flotation System serving 28 grinding machines at an International Harvester plant. The coolant serving the sickle grinding department is a water-base soluble oil.



A Hoffman Central Filtration System consisting of 9 Hoffman Pressure Filters, Model 1-80S, each equipped with Hoffman Dual Magnaflo Plates—with a flow rate of 150 gpm and sludge collector conveyor—(Magnetic separator), are shown at the plant of a leading automotive and aircraft accessory manufacturer.

This system enabled International Harvester to make the following savings:

Cleaning of coolant trenches completely eliminated —savings of $10,000 annually.

Trucking costs for the removal of sludge to a disposal point reduced 65.5%. Saves $8,122.50 annually.

Cost of grinding wheels reduced 47.4% — saves $65,477.19 annually.

Production per grinding wheel increased 134%.

Cost for wheel-change-over reduced 57.3%.

Adding these and others, the total savings for this particular year were significant.

The following tabulation is a percentage breakdown of actual savings made with this Hoffman Central Filtration System equipped with a Magnetic Separator and sludge collector conveyor for automatic removal of sludge collected by filters, magnetic plates and gravity settling.

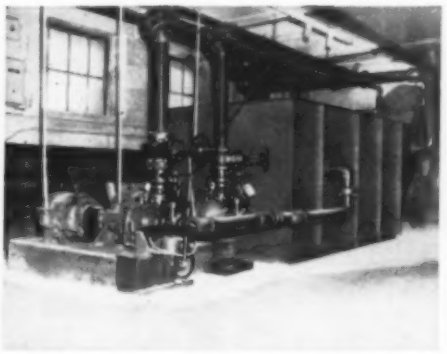
Grinding Oil 2.5%

Diamonds—Grinding Wheels 43.4%

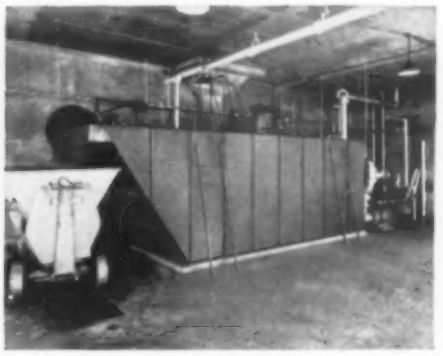
Production scrap (resulting from improved quality of product) 32.5%

Labor to operate system and actual production labor @ $2.00 per hour 21.6%

A Hoffman Vac-80 Vacu-Matic Filter is shown installed on a Norton 30" diameter stepped-wheel grinder for grinding transmission shafts at the Syracuse plant of a large automotive manufacturer. Most Norton grinders are equipped with Hoffman Vacu-Matic filters when shipped.



At the Union Twist Drill Co. in Athol, Massachusetts, a Hoffman Magnaflo Separator removes metal particles from oils and coolants to solve numerous clarification problems. Result—many money-saving improvements in manufacturing technology and product quality.



A money-saving Hoffman Flotation Unit at the Fafnir Bearing Company. It is designed for plant wide distribution of water-base coolant. The company credits Hoffman systems for great improvement in critical finish grinding operations on bearing races.

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Available in a range of fourteen sizes, Norton TUMBLEX "A" abrasive is capable of providing excellent cut and finish on a *wide* variety of work pieces. It will not glaze, but instead will maintain a continuous high rate of cut.

Let our Sample Processing Department show you a better way of finishing. Send us unfinished samples and one finished piece. We will barrel finish samples with TUMBLEX "A" abrasive — or with one of the other Norton TUMBLEX abrasives if more suitable. Our return report will tell you exactly how you can improve product quality while cutting finishing time and costs. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

AVAILABLE SIZES OF NORTON TUMBLEX "A" ABRASIVE

No.	Size	No.	Size
00	1½" to 2"	3½	5/16" to 3/8"
0	1⅛" to 1½"	4	1/32" to 5/16"
1	3/8" to 1⅛"	5	3/16" to ¼"
1½	1 1/16" to 3/8"	6	⅛" to 3/16"
2	5/16" to ¾"	8	3/32" to ⅛"
2½	½" to 5/16"	10	standard 10 mesh
3	3/8" to ½"	12	standard 12 mesh

*Trade-Marks Reg. U.S. Pat. Off. and Foreign Countries

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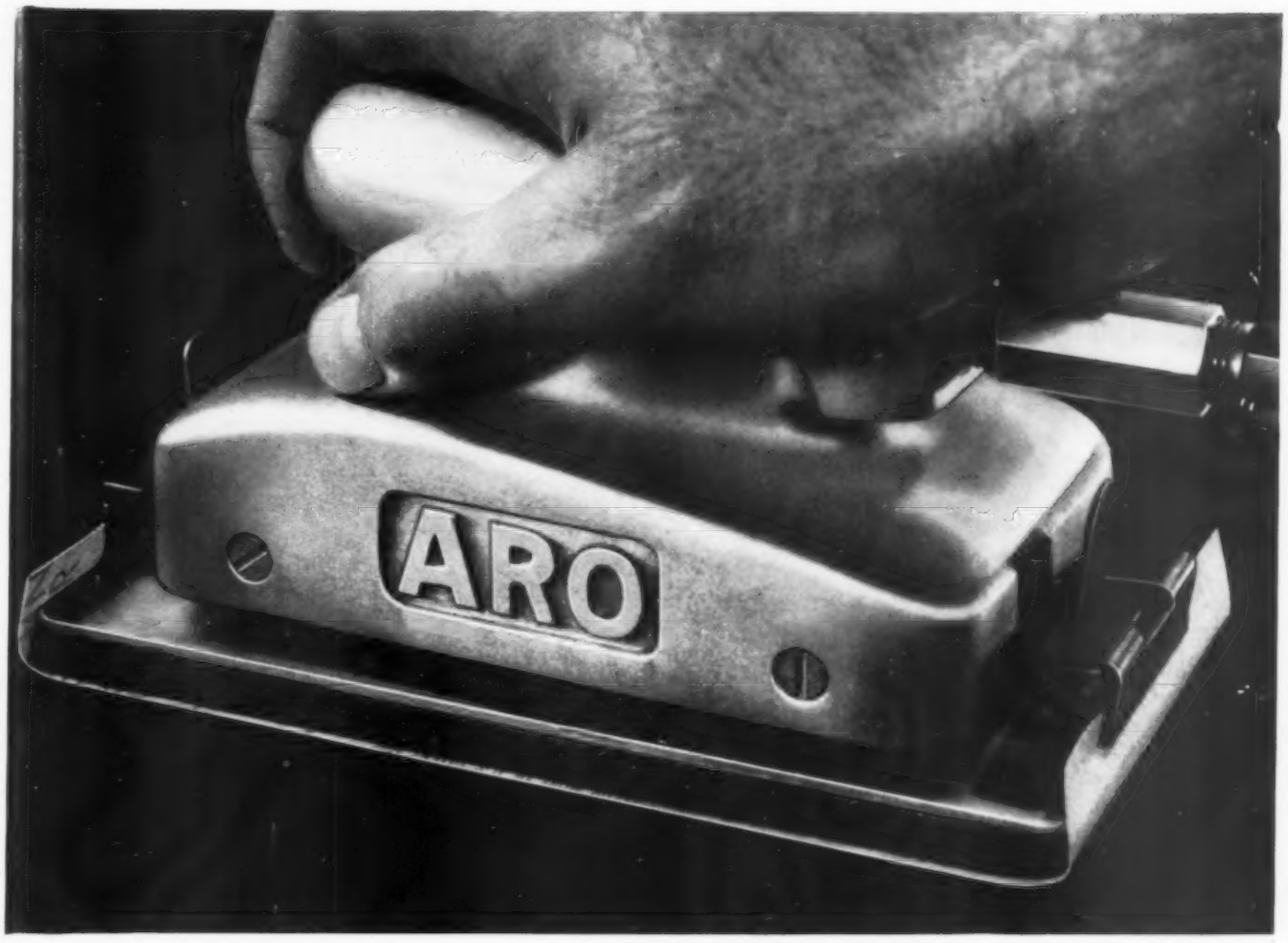

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Above is one of the four magazine-fed centerless type Heald machines which grind the bore of the tapered inner races.

Job Shop Production Grinding Anti-Friction Bearings at I. H.

By M. M. PATTERSON
Managing Editor

Job shop production runs and the manufacture of both ball and roller bearings in the same department is far from the normal high production runs and highly automated arrangement for bearing manufacture. International Harvester is faced with the problems of accurate scheduling of versatile grinding machines with a minimum amount of changeover time.

● The International Harvester West Pullman Works plant in Chicago is in the position of producing quantities of ball and roller bearings in their anti-friction bearing department in job lot size quantities. The anti-friction bearing department produces 67 basic sizes of ball bearings of which there are 268 types. 80 cone assemblies, with 48 sizes of cups and 16 size rollers, are produced by this same department.

This is the green grinding operation which is performed on a Blanchard Model 16-A. The operation is performed to provide consistent width of the inner race, so that the stamp of identification will be a constant depth.

The equipment in this department must, out of necessity, be flexible, have a wide range of capacity and also require a minimum amount of changeover time. Many operators set up and adjust their own machines on an incentive system. Additional reduction in costs are provided by extremely careful production scheduling. That is, the scheduling of various types and sizes of bearings to follow in a sequence so that the minimum amount of change over is required.

For the greatest economy and precision, almost all the operations in this anti-friction department are grinding operations.

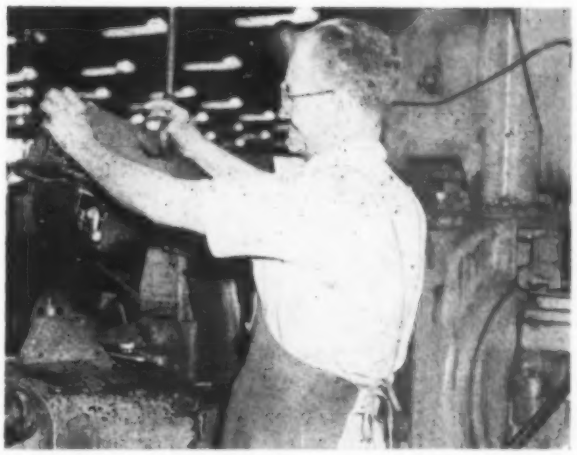
The first grinding operation is that performed on the inner races for the non-shield or seal-type ball bearings, which is called the green grind. This operation is performed on a single spindle Blanchard, model 16-A, using an aluminum oxide 60 grit E hardness wheel holding a tolerance of -.001" plus .000". The magnetic revolving table provides the flexibility of setup for the large range of parts. This operation provides a consistent width of the

inner race, so that the stamp of identification will be a consistent depth. This operation also removes a burr formed from the cut-off of the inner race. Stock removal is from .005" to .008". Coolant used is soluble oil. A large central system provides the coolant for the entire department. The material used for the inner races is a 52100 ball bearing material common to almost all ball bearings manufactured today. Floating floor inspection covers the green grind tolerances along with an operator spot check. No specific finish is required.

Heat treating of all parts is an atmospheric temperature controlled hardening to between 61 and 63 Rockwell C depending upon the various parts. The first operation after heat treating is face grinding of the inner-outer races and the cups and cones by 4 double-spindle Blanchards, which rough and finish grind. This area also includes one Besly-Welles double disc grinder. The smaller surface parts are run on the Besly-Welles machine, while the large surfaces are run on the Blanchards. The table speed on the Blanchard is .71 rpm; wheels are 18" x 5" x 10", A-60-EP and 18" x 5" x 10" A-60-112-B. The wheels on the Besly are 30" x 20" x ½" A-80M-L. Stock removal averages .014" per pass on the width. Inspection is again sampling every load by floating inspectors. Tolerance is .0003", total indicator reading for parallelism so that the rest of the grinding operations can be precisely located from these faces. The length dimension is nominal while the average raceway to face must be within .002", and the snap ring groove must also be within .003".

The wheels for the Blanchard grinders are sulphur bonded to the holder, as personnel at International Harvester have found that sulphur provides a good bonding agent while permitting easy removal of the remaining portion of the wheel. The finish on the Blanchard's and Besly's is considered for appearance sake only. These machines are equipped with an adjustment for automatic size control and wheel wear compensation. A unique lazy susan type hopper arrangement allows the operator to run these parts through a single machine for a number of passes depending upon the stock removal requirements. After the final operation by these machines, the parts are demagnetized and passed through a washer to remove steel particles.

The next operation is the grinding of the outside diameter of the inner (land) and outer races, and the cups for roller bearings. All centerless grinding machines are used in this operation, consisting of (2) No. 2 Cincinnati centerless grinders, (6) No. 3 Cincinnati centerless grinders, and (1) No. 4 Cincinnati centerless grinder. Stock removal on this operation ranges from .010" per pass to less than .0001" according to size. Finish requirements are under 25 rms, rate of feed being approximately 36" per minute. Tolerances, again depending upon size of the bearing, range from .0004-8" T.I.R., O.D., out-of-round, and parallel to sides. Taper is held to .0004" over all. Inspection of the outer races is



The Besly-Welles double disc grinder shown above is used to face grind inner-outer races and the cups and cones. Tolerance is held to .0003" so that the rest of the grinding operations can be located from the faces.

performed at the last pass, covering about one out of every ten for dimensional accuracy and visual appearance. From four to ten passes are made on each part, depending upon size, stock removal, and out-of-round. The inner and outer raceway O.D.'s are ground on the same Cincinnati centerless machines. Two gages are used for checking these parts, a 3-point gage to detect out-of-round, and a 2-point gage for diameter. Here again the coolant comes from the central system, which utilizes two Hoffman Clarifier Flotation units for coolant cleaning of all the coolant in this department.

31 Van Norman radius grinders perform the raceway grinding, using rubber bonded wheels. Four sizes of Van Norman's are used to provide the

This centerless grinding operation is being performed on O.D. of the outer races by a Cincinnati machine. Tolerance ranges from .0004-8" T.I.R., O.D., and out-of-round. Note the unique lazy susan type hopper which allows for running the parts through for a number of passes.

Above is shown the feed arrangement for a Cincinnati centerless grinder. Note the hardened steel bars that are quickly adjusted for setup change.

range required. These grinders are equipped with oscillating heads so that no dressing is required. Diaphragm chucks provide for easy setup, many of the bearings having the same O.D. Stock removal is from .007" to .010" on the diameter to .012" to .015" on the larger diameters. Finish is held to 15 rms.

Tolerances on the raceway diameter are .0006" to .0008". The finish is obtained by dry grinding on the last 6 oscillations of the Van Norman machines. The coolant automatically shuts off and then comes back on to cool the piece. One gage is used to provide the measurement of the raceway diameters, eccentricity and raceway to face run out. One operator runs between 2 and 3 machines, depending upon the time cycle per piece. A tram rail is provided for stock handling the ground parts which are put into baskets and conveyed to the next operation. In this way they avoid operator handling of the parts from one operation to another.

This close-up shows an operator inserting an outer race in the diaphragm chuck of a Van Norman radius grinder. The diaphragm chuck helps reduce setup time.

Finish required for the raceway is under 10 rms, which is accomplished by a polishing operation. This polishing operation is performed by hand. The operator mounts the inner and outer races on a collet and, by indexing an abrasive belt on a hand holder, presses it against the raceway while it is rotated on the collet. Only the outer races whose inner race bores are 60 millimeters or smaller are polished on the raceway polisher. This piece of equipment was developed by International Harvester.

On all ball bearings in which a maximum number of balls for the application are used, the races must be slotted for assembly of the balls. One third of the production is of maximum bearings type and, therefore, requires the grinding of the slot after race is ground. The slot must be held to within .003" which is a tolerance that could not be held in milling. This dimension is from the center of the raceway to the loading groove. Essentially a hand operation, the operator grinds the groove on a belt driven spindle, using a vitrified mounting wheel without coolant. The races and cups then go into baskets which are passed through a mineral seal washing. This is the final washing prior to the assembly. Parts are then size matched through the use of 100% inspection.

The outside diameter of the inner races is ground for two reasons:

(1) To provide a smooth surface for those types of bearings which are sealed.
(2) For shuttle chucking during the inside diameter grinding.

The inner race bore is inspected 200%. As the

Finish of the raceways is obtained by this hand operation which utilizes equipment developed by International Harvester. A coated abrasive belt is held against the raceway as it is rotated.

function of the bearing depends upon a press fit, this inspection is on piece work performed by the grinding operator, which is then reinspected by day workers. The average bore tolerance is within .0003 to .0005, depending on size. This double inspection minimizes the human error. Finish of these bores must be under 20 rms, as is the case of the ball or roller. Four Model No. 170 Heald Gagematics are used for bore grinding with one operator. These four automatic bore grinders are sample inspected. The Model No. 170 Heald uses a sulphur treated wheel, which gives more wheel life at high speeds approximately 25,000 rpm. This, of course, depending on the size of the wheel.

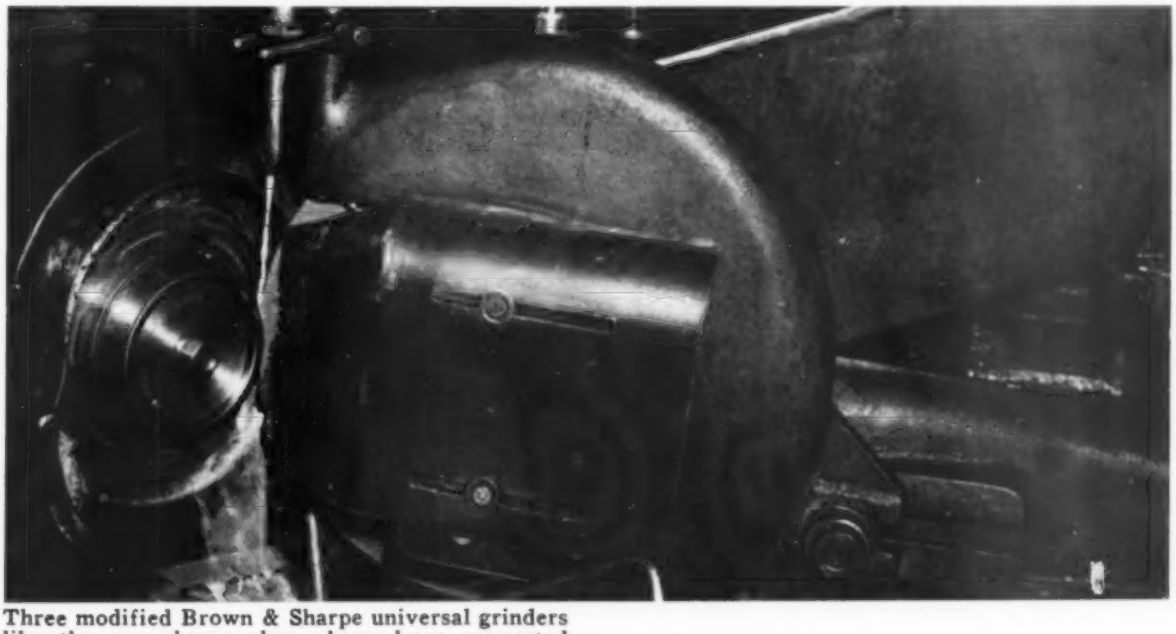
There are twelve No. 81 and twelve No. 72 Heald Gagematics with one operator for each two machines. Four No. 81 Heald's are magazine fed, centerless type, used for bore grinding of the tapered inner races. O.D. of cones are plunge ground on 6 Cincinnati chucking machines. The accuracy here is .001" on the raceway. The raceway of the cones are ground before bore grinding in order to obtain a finished concentricity dimension for centerless bore grinding. The I. D. of a tapered cup is ground on eight No. 81 centerless type Healds with one operator operating four machines. Finish is held under 20 microinches with a tolerance of within .001".

There is a flange grinding operation on the cone, which is performed by 3 modified Brown & Sharpe Universal grinders, which have been converted for this rib grinding. A Gisholt superfinishing machine is used to reduce the cone raceway finish to under 12 rms.

All the balls are purchased outside, however, the rollers are ground on No. 2 Cincinnati centerless machines, using 3 passes—2 rough and 1 finish. The tolerance is a selective tolerance within .00025", the finish under 6 rms. Material for the rollers is 4720 case hardened steel. • • •

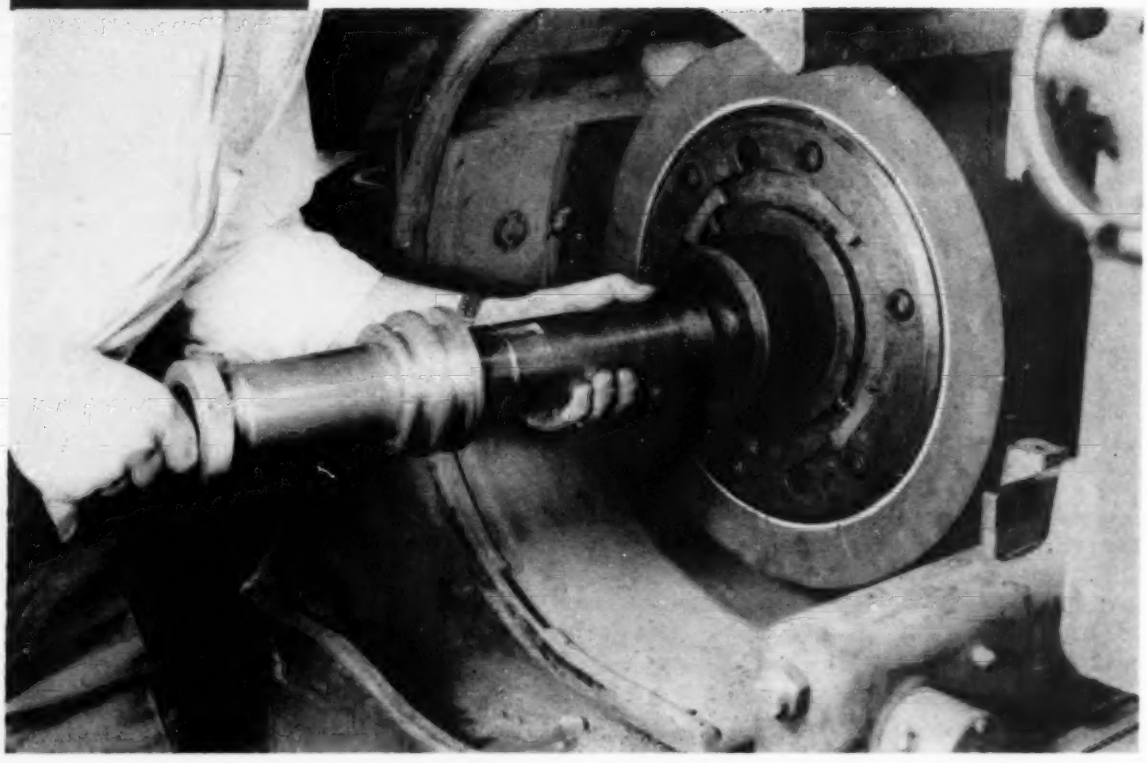
Maximum bearings require a slotted raceway for assembly of the balls. Dimension from the center of the raceway to this loading slot must be held to .003".

Two gages are used for checking inner and outer races, a 3-point gage for out-of-round and a 2-point gage for diameter.



Three modified Brown & Sharpe universal grinders like the one shown above have been converted for rib grinding of the cone.

Why Wheel Balancing?



A static balancer that does not require removal of the grinding wheel to some distant point is shown. The anti-friction arbor is being attached to the grinding machine spindle. The wheel will be pulled forward onto the arbor and a split tapered bushing installed behind it. For balancing, the wheel is pushed back onto the bushing, requires less than 30 minutes of grinder downtime.

By E. J. KAISER
Product Specialist
Aero Supply Mfg. Co. Inc.

● Balancing of grinding wheels is too often considered necessary only when high-precision work is being done. The progressive manufacturer and job shop manager realizes the importance of balanced wheels in obtaining the full production potential of the grinding machine, but many still think of balancing only in terms of obtaining closer tolerances and better finish.

Untold quantities of abrasives are "dressed away" daily in an attempt to correct imbalance; for while dressing the wheel may tend to minimize the effects of imbalance, it does not correct the basic fault. For this reason grinding machine manufacturers have provided a groove, and movable balance weights to fit in the groove, in the wheel flange or hub. Balance is considered so important that one manufacturer has developed an automatic balancer as an integral part of his grinding machine. The grinding machine operator simply moves a lever on the machine, and balance is accomplished in seconds. This has received widespread acceptance by industry and is now incorporated on several models as standard or optional equipment.

Tests conducted for the purpose of determining the savings realized by having a balanced grinding wheel show that a balanced wheel will grind approximately 50% more pieces satisfactorily between dressings of the wheel. This means that if, for example, 30 pieces of a certain job can be ground before it is necessary to dress the unbalanced wheel, then the wheel will be dressed three times before 90 satisfactory production pieces are ground. If the wheel is balanced, it should be possible to produce 90 good pieces with only two stops for wheel dressing. Assuming an equal amount of abrasive is dressed away each time, an abrasive saving of 33% will be realized if the wheel is balanced. Also, since one out of three stops for dress will be eliminated, there will be a 33% time saving which may easily be more than enough to compensate for the downtime required for wheel balancing.

Balancing of wheels will allow grinding of 50% more parts between dressings. This in turn results in less wheel dressed away, less down time for dressing and increased production. Clearance between ID of wheel and OD of spindle necessitates balancing of new balanced wheels when placed on the machine.

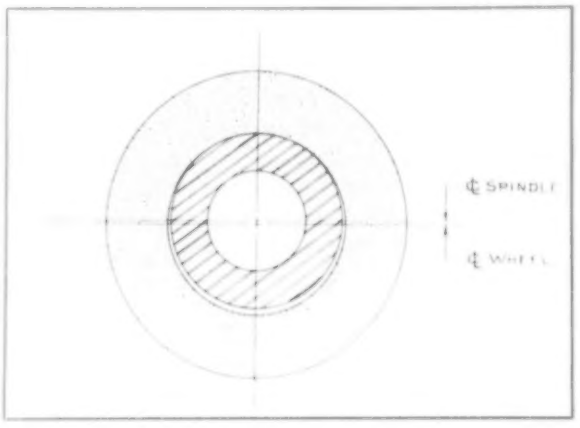
The time saving due to reduced stops for dressing is not the only time saved. When a grinding wheel is balanced its entire circumference bears on the work with equal intensity. Each piece is thus ground faster since fewer revolutions of the grinding wheel are required to remove a given amount of stock. This, plus reduced dressing away of abrasive, plus time savings due to reduced wheel dressings, accounts for the increased production efficiency of grinding machines with balanced wheels. It is to be noted that these savings are independent of the need for close tolerances and a high degree of surface finish; a certain consistent quality is usually required of ground work, whether the specifications call for ± 0.010 and 125 RMS, or ± 0.0001 and 4 RMS.

Grinding wheel manufacturers employ rigid quality control systems to help the user get maximum benefit from their wheels. Strict measures are taken to see that the density of wheels is as nearly uniform as practical, and that the wheel is in near perfect balance when shipped. Nevertheless, wheels need balancing again after mounting. There must necessarily be clearance between the ID of the wheel and the OD of the wheel collet to permit mounting; the usual method of mounting can leave the wheel .001 to .015 in. off-center from the rotational axis of the spindle. Thus the wheel and hub must be balanced together, to avoid the vibration or pounding that results due to this clearance.

There is static balancing and dynamic balancing. In static balancing the wheel is not rotating; the resultant of all the unbalanced weight in a rotor has the effect of a single weight in one plane, causing the rotor to have a heavy spot. For dynamic balance the wheel is rotated and the net result of all unbalanced weight is, in effect, two weights 180° apart in two separate planes which cause the rotor to rock or twist on an axis perpendicular to the axis of rotation.

Static balancing consists simply of mounting the wheel on a balancing arbor and placing this on parallel knife edges or overlapping discs which rotate on antifriction bearings. With the arbor thus free to turn, gravity can pull the heavy side of the wheel down. This indicates where weights are to be placed to counterbalance the off-center weight. Weights are placed only in one plane.

Methods and equipment for dynamic imbalance measurement are more elaborate. Since dynamic imbalance is caused by the effect of two weights in separate planes, counterbalancing normally requires addition or removal of weight in two planes. A wide and varied assortment of dynamic balancing machines is available. Some require that the grinding wheel assembly be removed from the grinder and mounted on the balancer. Others are portable so that the wheel need not be removed from the grinder. Many dynamic balancing machines are designed for high-production balancing and do not readily lend themselves to individual balancing applications. In many cases the benefits of dynamic balancing cannot be fully realized because the wheel collet will permit correction in a single plane only while dynamic balancing equipment indicates correction needed in two planes. Portable



An illustration of the most common reason why grinding wheels require balancing after mounting. The difference between the inside diameter of the wheel, and the outside diameter of the wheel collet, permits the wheel to be 0.001 to 0.015 in. off-center from the rotational axis of the spindle.

dynamic balancers cannot be used to measure true dynamic imbalance since the grinding wheel, being restrained on its spindle, cannot exhibit the effects of rocking or twisting perpendicular to the axis of rotation.

Except in very rare accidental circumstances, imbalance in a rotor is always dynamic imbalance. However, if a rotor is stiff and is relatively narrow in relation to its diameter, it may be assumed that its weight is all concentrated in one plane. The two weights causing dynamic imbalance will be in planes so close together that they may be considered as in the same

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plane. Thus, for narrow rotors, static balancing, with counterbalance weights in only one plane, will satisfactorily correct imbalance. A grinding wheel is such a stiff, narrow rotor.

Static balancing is normally a much slower process than dynamic balancing. This is primarily because most static balancers require removal of the wheel from the grinder, insertion of a balancing arbor, and mounting on knife edges or overlapping discs. Recently, an anti-friction arbor has been developed which attachs directly to the grinder spindle. Thus static balancing can be done without removing the wheel from the grinder. This reduces the overall static balancing time to less than 30 minutes for the entire operation.

This development also eliminates the need for a hoist or helper for moving the heavy wheel from its machine to the balancing ways. The device is light weight and portable so it is easy to use it on several machines. Cost is low enough so that the user of only one or two grinding machines can afford to own one.

Several tips for operating practice will aid in balancing wheels and in maintaining their balance, so that maximum productivity of grinding machines can be realized. When mounting a new wheel or changing wheels, much trouble will be avoided if care is taken to rough-true the wheel prior to balancing. Then the entire wheel assembly is balanced. Then finish-truing is done. This procedure should also be followed when mounting wheels which have had prior use. The desirability of truing, then balancing, then truing again, places a premium on the type of balancing equipment which does not require removal of the wheel from the grinder.

The flow of coolant on a grinding wheel should be shut off before stopping the wheel and the wheel allowed to run for about five more minutes. This will permit the wheel to throw off excess moisture. Otherwise, coolant remaining in the wheel will drain to the low side with resulting imbalance when the wheel is started again.

Wheels should not be stored in such a manner that they might become oil soaked or pick up moisture from the floor. This will create imbalance, and an oil-soaked wheel will impair the finish of the work being ground.

When a wheel is mounted, care should be taken to attach the flanges with bolts of the same length. The normal length tolerance of bolts is generous; variation of as much as ½ inch have been found between two mounting bolts of the same nominal length. This is enough difference to cause a serious imbalance condition.

Wheels should be checked often during their use to determine if they are still in balance. The several dressings which a wheel receives during its life may alter its original heavy spot and thus destroy the balance achieved when it was originally mounted.

Certain wheel flanges have holes for the attachment of a wheel puller. Grinding swarf can enter these holes, and settle when the wheel is shut down. Eventually, this accumulated swarf will adversely affect the balance. This is easily prevented by installing corks in the holes to prevent entrance of swarf.

There are many other things that can cause grinding wheel imbalance; too numerous to mention. But the correction of such imbalance is not a mysterious operation. It is simple and can be accomplished with reasonable speed. The results are so satisfactory that those who pay attention to proper balancing usually find that the occasional half-hour spent saves days and weeks of production worries, for although balancing is not the only problem connected with grinding it is the major factor usually overlooked in avoidance of grinding troubles. • • •

Cincinnati Milling Machine Co. Celebrates 75th with "Adventures in Progress"

● Almost 5,000 engineers and production people attended the "Adventures in Progress" celebration of Cincinnati Milling Machine Co.'s 75th anniversary of service to the metalworking industry. CMM Co. visitors were conducted on a day-long tour during which they observed 87 individual demonstration machine tools in operation. More than 20 new machine tools announced, were designed to "break the cost barrier."

The tour itself was note worthy for such technical taste cutters as a brass band, jungle safari, turntable, wagon train and a mock political rally which was held in the "Cimasphere" shown above. This air-supported bubble tent was the scene of the rally which ended the tour. Frederick V. Geier, chairman of the board, acted as keynote speaker of the rally, but his message

was of a very serious nature. He told the guests that, "our very survival as a nation depends in a large part on progress in machine tools."

The nominations at the "political convention" went to the three outstanding cost cutting machines of the show. One of these machines was a new Automatic Cutter Grinder which is covered in detail on the first page of our Equipment and Materials Department.

It is quite obvious that "Adventures in Progress" was even more than what we should expect from the largest American builder of machine tools on their 75th anniversary. • • •

Evolution of the water pitcher from sheet copper to sterling silver finish. Over half the work that goes into the manufacture of the pitcher is devoted to grinding, and polishing and buffing, which underlines the necessity of the best material and methods for the job. Photos courtesy Chapman-Novak & Associates, Inc.

CONOMY IN BUFFING AND POLISHING . . A WATER PITCHER

Oneida Silversmiths' greatest concern is with the finishing of their flatware and hollow ware. To bring the silver-plated water pitcher within the average budget Oneida has had to achieve economy through a continuing testing program while maintaining a scrupulous regard for quality.

● The silver-plated water pitcher—is the product of approximately 67 different manufacturing operations. It is the combined result of complex manufacturing processes, plus individual craftsmanship. Yet, for the first time, this pitcher is within the budget range of the average American family.

This situation results from one basic fact: the development and use of the latest techniques in silverware production by such firms as Oneida Silversmiths in Sherrill, New York. Oneida is one of the largest manufacturers of silverware in the world, employing 2,000 personnel in their large plant in Sherrill.

In the manufacture of flatware and hollowware, Oneida's greatest concern is with the finishing operation. Of the 67 operations that go into the production of a water pitcher, over half of them are devoted to

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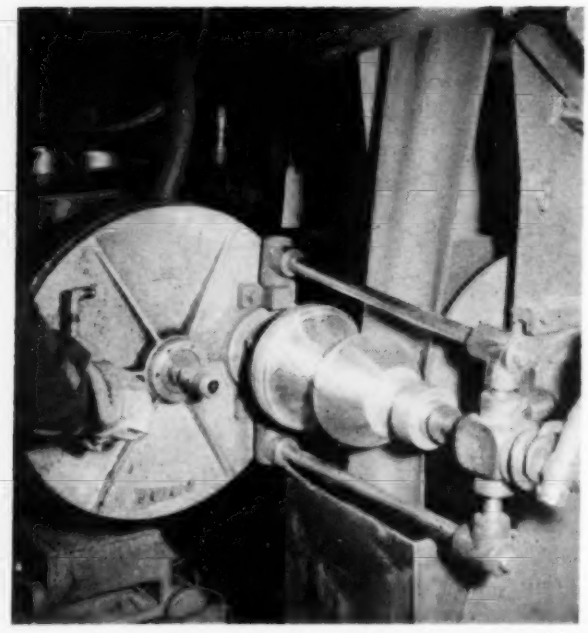


This automated operation has achieved considerable economies for Oneida in contrast to the hand methods used before. Using the Divine Contour Polishing Machine work out-put has been increased 600%. A contour contact wheel can be seen behind the emery abrasive belt. Three different grit sizes are used on each work load: 120, 180, 280.

grinding, polishing and buffing. In terms of supply alone, Oneida uses enough buffing material each year to stretch a yard wide bolt over 400 miles. If the most modern and efficient methods were not used, the same water pitcher would not be available to the vast number of homes that it is available to today.

Six Major Finishing Operations

Prior to the buffing and polishing operation, copper is received in sheet form. This is stamped into dimensional sections by special dies and then drawn into a somewhat pear-shaped form. At this point, the first of six major finishing operations takes place.

The first operation is a semi-automatic operation called the initial auto-buff, which polishes the outside of the pitcher. In the past this operation was done entirely by hand.

When it was done by hand, it took one man an hour to do five to ten pitchers. It would take approximately 60 hours to do an entire work load of 300 pieces. At present, this key operation has been automated with a Divine Contour Polishing machine. The results are impressive: operated by one man the machine can produce thirty-five pieces per hour or six times as much as by the hand method. Besides the economies achieved, the work turned out is actually superior because of the uniformity obtained in machine operation.

The most noteworthy single factor is the operation of the machine itself. The belt assembly consists of: two pulleys, a contour contact wheel and an emery abrasive belt. The abrasive belt is changed three times during the polishing of each run of work, yielding cuts of 120, 180, and 280, in that order.

The other major component of the machine is a semi-automatic work-holder seated on a pedestal unit. The spindle of the work-holder holds the pitcher and revolves it against the moving abrasive belt.

Two spray lubricants are used with the operation. One is used to spray the pitcher itself in order to lubricate the cut, the other is used to clean out the belt. Kerosene is used in this second instance because of its low susceptibility to flash firing.

After this polishing of the outside, the pitchers move in specified work loads to the next polishing operation, which is polishing the inside of the pitcher. Polishing the inside of a pitcher is necessarily a hand operation. Economies have been effected, however, through the use of the best buffing material, the right compound and the most appropriate grit size. A Lea compound is used on a Divine Goblet buff, the operator moving the pitcher over the revolving buff and slowly rotating the pitcher. The buffing cloth employed has a 48/48 thread count at 2.50 weight.

At the third major operation, the pitcher is air-blown inside and thoroughly inspected.

Industrial trucks carry the work load on pallets back to another major auto-buffing operation, designed to give an even finer finish to the outside of the pitcher. Again a semi-automatic work-holder is used, this time in conjunction with a lathe and buffing wheel. The

Polishing the inside of the pitcher is necessarily a hand operation. A Divine Goblet buff is used in conjunction with a Lea Compound, with thread count of 48/48 at 2.50 weight.

The final buffing operation is performed by hand after the pitcher has been silver plated. A greaseless compound is used on a Divine Full Disc buff. The buff is packed according to a special method Oneida has developed through their continuing program of testing.

pitchers are held by a spindle on the work-holder and the entire unit moves in a set cycle. The buffing wheel revolves on the lathe. This operation, too, was once a hand operation.

After this operation, the pitchers are formed, trimmed and assembled. Handles, lips and feet are soldered on.

For the fifth time the pitchers go through a complete buffing operation. Then the entire work load is moved into the plating room for the coat of silver which gives the beauty and protection desired.

Final Finish

After the plating operation, each pitcher emerges with a slightly milky color. To eliminate this and provide the type of final finish that Oneida insists upon, one more complete and comprehensive buffing operation is performed by hand.

In the past a red rouge compound was used in this operation. Oneida found that this was a rather messy operation, however, and particularly hard on the men performing the job. Their testing program indicated that they could change to a greaseless compound and make the work safer, easier and actually more efficient.

Oneida uses Divine Brother's full disc form, buffing wheels for this final operation. Oneida packs the buff according to a special method they have developed. The full disc buff is either 86/93 or 86/88 thread count at 2.60 weight. • • •

Centerless Belt Set-Up Grinds Long Tubes

● In its San Francisco Plant, Otis Elevator Co. is centerless grinding to a specified finish, and almost perfect concentricity, tubular steel elevator plungers up to 16 in. in diameter, some of them as much as 56 ft. long. Work is fed to the coated abrasive belts at 65 ft. per min., and on some diameters, stock removal reaches ½ lb per min. at an abrasives cost of less than $0.10 per lb.

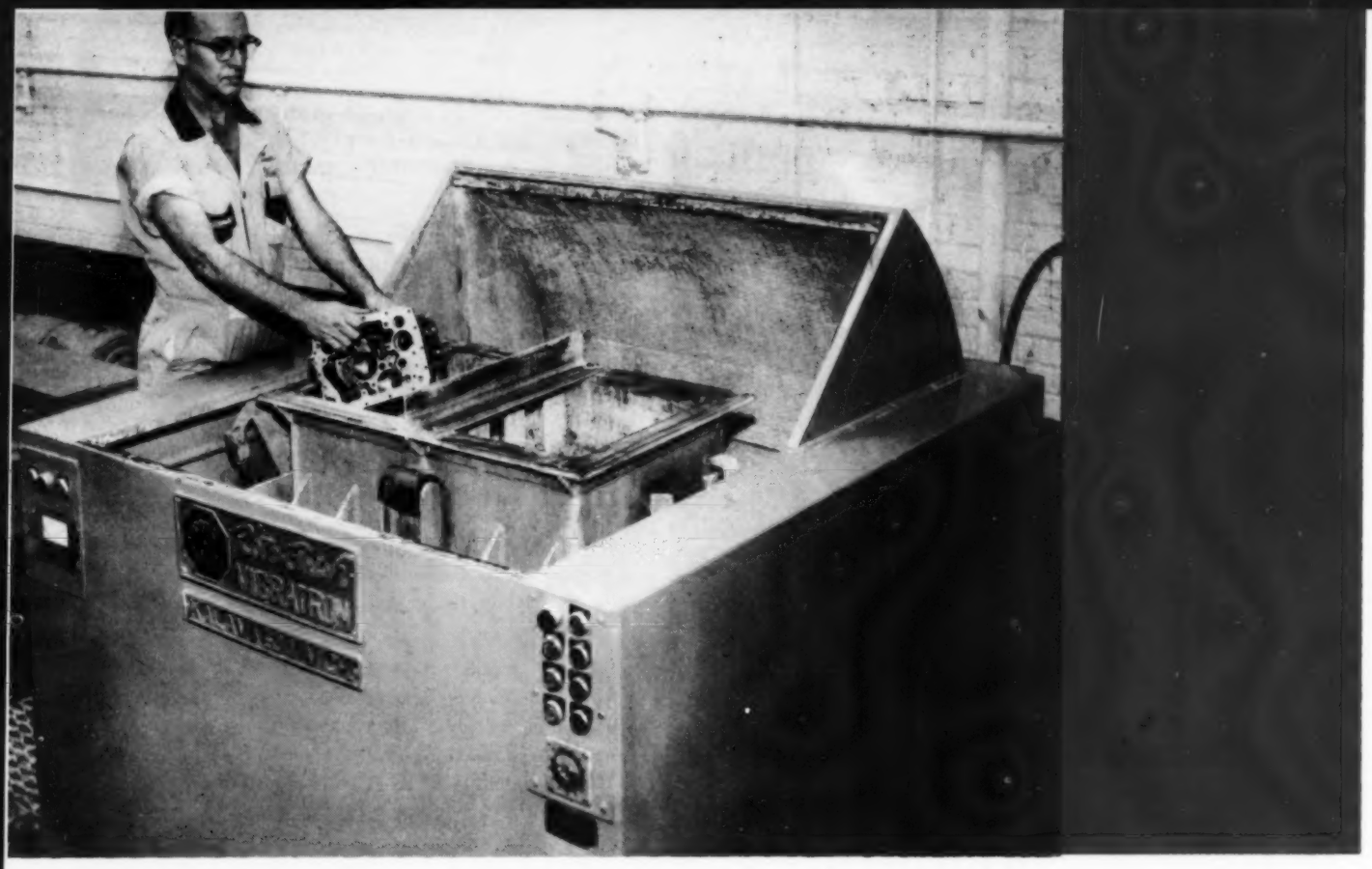
Mild steel pipe 4- to 16-in. diameter is descaled, high spots are removed and the pipe ground in a Model 614 Production Machine Co. centerless grinder. The pipe, with wall thickness from 5/16 to ¾-in., is held to ± 0.002 in. roundness on smaller sizes through 6-in diameters, and to ± 0.003 in. on larger sizes. Surface finish required is 16 to 32 microinches.

Production engineers from Behr-Manning Co. helped to establish the grinding procedure, which is now standardized with 40-grit 6 x 168 in. aluminum oxide cloth belts with all-resin bonds, running at 3500 sfpm. The steel contact wheel measures 16 x 6 in. and has ¼-in. spiral serrations. Normally, stock removal ranges between 0.100 asd 0.150 in. on the diameter. More than 100 lb of steel is removed from a 12-in. pipe 20 ft long.

Finish is attained by making several passes with a 100-grit aluminum oxide belt, then one or two clean-up passes with grit 180. The work is flooded with a sulphurchlorinated oil, providing better cutting performance than coolants tried earlier.

The grinder has been modified in several ways to expedite production. Powered extension tables have been added to handle longer workpieces, and a cloth filter system of 200 gal. per min. capacity keeps the coolant clean; in addition, an electrostatic precipitator has been installed in the dust-collecting system. Finally, for fire protection, a carbon dioxide bottle, with release controlled from the operator's console, has its tubing outlets run to the grinding area and to four points in the dust-controller housing. • • •

Close-up of centerless belt grinding machine which handles work-pieces up to 56′ in length. Even on large diameter work such as this elevator tube, centerless grinding holds roundness to plus or minus 0.003″.



Above is shown the loading of the Roto-Finish Vibration at Woodward Governor Co. Machine is quiet enough to be placed in any manufacturing area.

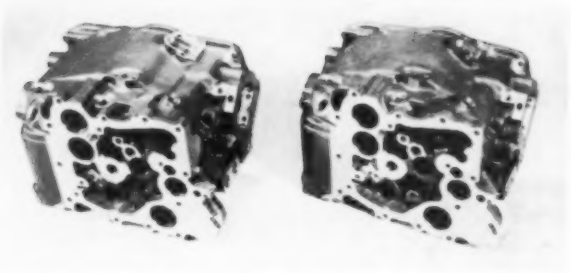
Vibration Deburrs Hard-to-get-at-Areas Reduces Time

Woodward Governor Co. recently installed a vibrating type finishing machine not only for the increased savings which it did result in, but for precise finishing of the inside of castings. Four difficult to finish parts are discussed.

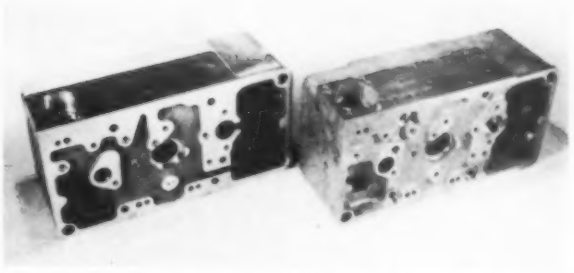
By M. M. PATTERSON
Managing Editor

● Woodward Governor Co., Rockford, Illinois, has been, since their beginning, a manufacturer of ultra-precise equipment. Woodward is a world leader in the development and manufacture of governors for all types of prime movers including such highly precise equipment as jet engine fuel controls and aircraft components. With this background, it is easy to understand the extreme care which is taken by management in every purchase of new manufacturing equipment. One of the most recent purchases has been a 7 cubic foot capacity Vibratron, manufactured by Roto-Finish Co., Kalamazoo, Mich.

The Vibratron caught the eye of Woodward personnel because it could finish faster, more precisely, and finish hard-to-get-at-areas inside castings. Most of the parts which are now being processed on the Vibratron were formerly precision deburred by hand following conventional tumbling methods.



The aluminum cases above are used in jet fuel controls. Part on the right has been finished in 10 minutes and hand deburring reduced from 5 or 6 hours to 4 hours.



Cast iron case was tumbled and hand deburred at a rate of 3 per hour, the finished part on the right was finished in 10 minutes.

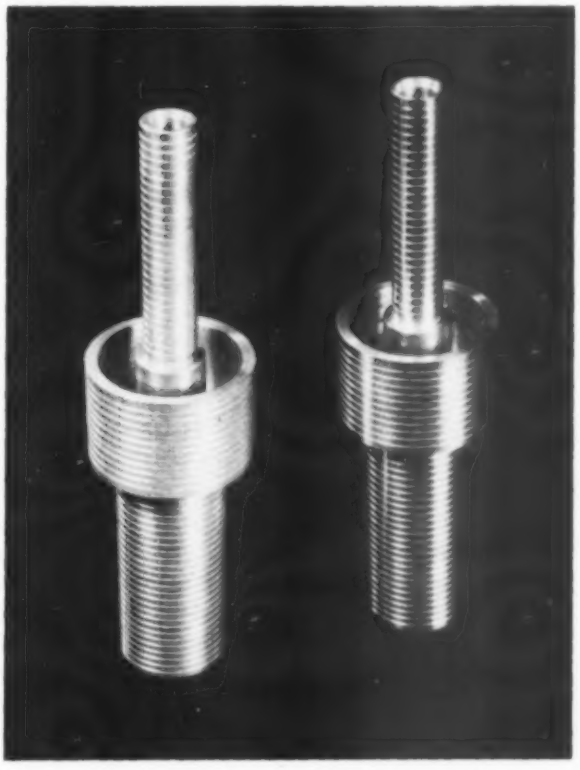
One of the problem parts has been an aluminum piston on which oil grooves require deburring after OD grinding of the piston. This piston is used in jet fuel control systems. Conventional tumbling did not remove the burrs and the oil groove was being cleaned up by hand, using an abrasive rope. The operation took 10-15 minutes per part. Processing through the Vibratron, using No. 7 chips and aluminum cutting compounds, Woodward finishes to their specifications 225 parts per hour.

Another part now being processed on the new machine is a cast iron case used in diesel engine controls. This part is approximately 22" high x 8¾" square, hollow shell type casting. Previously this part was tumbled and hand burred at the rate of 3 per hour. Now these parts are finished in 10 minutes each, using a bonded aluminum oxide chip No. 4½ and cleaning compound which is alkaline to keep chips clean. No additional hand work is required.

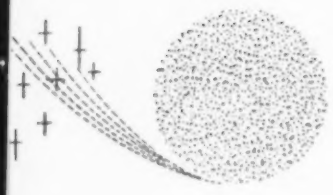
An aluminum case used in jet fuel control systems required hand deburring completely. Following the deburring, this part is inspected by using 10x binoculars. Woodward then began using barrel finishing and cut the hand deburring to 5 or 6 hours per part. Barrel finishing using preshaped "T's" with a burnishing compound took 1 hour 15 minutes. These same parts are now processed through the new machine two per load in 10 minutes. The charge consists of preshaped triangles and aluminum cutting compound. The Vibratron uses only two pounds of compound per load as compared to the 20 pounds of compound used by the conventional to process five parts. Hand deburring after vibration of the part was cut to four hours. The uniformity of the finish greatly increased the ease of inspection and handling of this part. The greatest increase in deburring action on this part was in the interior or hard-to-get-at-areas.

Still another part is an aluminum column which has the same history as the aluminum case. For this part the hand deburring was cut ½ hour and a much better appearance was achieved internally. In operating the Vibration, Woodward personnel found that water level and amount of compound have the most effect on the operation. On aluminum they started with a 10 minute cycle to obtain fast cut-down and good finish, but, it was found that the finish got much better only after water was added. This did not affect the speed of cut-down. For aluminum and fine parts they suggest short amplitude. Machine was purchased with variable frequency, but 95% of their work is done using 360 cycles per minute.

Other points which are impressive is the quietness, (enough to be placed in any manufacturing area), simplicity and low maintenance. The only moving part is the motor rotor. The 2 h.p. motor and vibrator is in a self-contained unit. The cover and loadings are automatically controlled, hydraulically actuated. Woodward operates their machine 18 hours per day and have not required down time to date. Breaks for radiusing can be controlled between .030" and .001". • • •



The parts shown above are aluminum pistons on which the oil grooves must be deburred. On the left is the rough while the part on the right has been finished in the Vibration.



Accurate Shop Testing of Diamond Wheels

By JOHN W. RIPPLE
Product Manager, Diamond Products
Bonded Abrasives Division
The Carborundum Company

● "If only we had some method of testing diamond wheels so that we could trust the results!"

With thousands of dollars at stake every year in a shop of any size, the need for tests for diamond wheels is obvious. Many testing methods have been worked out, but most are inadequate.

Weighing and measuring the wheel and the work before and after grinding is valid and establishes a ratio of wheel wear—but this is for the lab, not the shop. To get accuracy requires more precision equipment than most shops can justify.

The short test and the torture test are others. In the first, specified amounts of stock are ground from a test piece, with the wheels measured before and after the grinding. If enough tests can be run, this could be satisfactory, but a small error in measurement could balloon into a large variation in actual results under normal shop conditions.

In the "torture tests" two wheels are compared at high infeed rates for a specified number of pieces. This is known as "giving the wheels a real workout," but it is exactly opposite to recommended shop practice. The results are completely undependable.

Recording the dates that a wheel is put on new and taken off worn out is another possibility.

If a shop has a large number of one type of tool coming through regularly, all wheels can be tested on that tool only. Once a standard number of tools per wheel has been established, test wheels can be run against the standard. For any shop which has such a tool, this is a good test method.

Recommended Test Method

The proposed test method, it is believed, is adaptable to conditions in most shops, including those which have a wide variety of non-repetitive work.

For the test, three wheels are required. The two wheels to be compared must be new. The third need not be. One of the test wheels, normally the one currently in use, is the standard wheel. The second is the test wheel. These are carefully measured and the dimensions are recorded before the wheels are issued to the test operator. When he gets the wheels, he mounts them carefully on wheel mounts to secure greatest concentricity. Each wheel remains on this mount throughout the test.

All work which comes to the test machine is carefully sorted into two equal groups. These should be as nearly identical as possible, containing the same number of pieces with heavy stock removal and with light. The third wheel is used on the odd work.

For instance, suppose that a lot of eight cutters is to be ground. One cutter has a new tip, which will require considerable stock removal. The others are in normal condition.

In this case, three cutters would be ground with the standard wheel, and three with the test wheel. The odd cutter and the one with the new tip would go to the third wheel.

This procedure is repeated until one of the wheels being compared is used up. No record of pieces need be kept, since both of these wheels are grinding identical piece-parts. The amount of diamond abrasive section remaining on the surviving test wheel is the measure of its superiority. The performance of the standard wheel is considered as 100%.

For example, suppose that .250" was worn off the standard wheel and .202" off the new test wheel. Dividing the wheel wear figure for the standard wheel by the wheel wear figure for the test wheel (.250 ÷ .202) gives a result of 1.24, or 124% performance for the test wheel.

A 10% margin is provided to take care of normal errors. The test wheel should run at least 110% of the standard wheel before the latter is replaced, or less than 90% of standard before the test wheel is dropped.

Advantages of this procedure are:

It requires a minimum of records. Wheel measurements at the beginning and end of the test are the only data required.

Both wheels are treated equally. There is no question about which wheel did more work.

It is adapted to shop use.

On the other hand . . .

Three wheels are required where one would normally be used.

Wheels must be frequently changed, which makes the test less practical for large wheels.

Considerable time may be involved, since both wheels must be nearly or completely worn out.

It is strictly a wheel-to-wheel test, based on current conditions.

However, if the operator understands the method and is careful in conducting the test, and if the test is repeated at suitable intervals—say once a year, or whenever there is a substantial change in the character of work going through the shop—this method will provide shops with a better and more practical test than most that are now in use. • • •

Gages for Volume Production; Ultrasonic and Optical Gaging

Number 4
of a Series

Gaging for high-volume, high-precision production involves electric and electronic instruments, often with air gage heads. Tolerances up to millionths at speeds up to 700 per minute. Optical and ultrasonic gages fill unique needs, could well develop more general uses.

By RICHARD L. McKEE
Associate Editor

● It is freely predicted today that every production grinding machine, in only a few years, will have some form of gage built in. One needs only to review the results of such equipment, or to scan the literature available, to reach the same conclusion. Published material gives the impression that if the manufacturers were asked to gage bullets shot out of a machine gun, they would find a way to do it. Sorting might be a problem because of muzzle velocity, but they would probably find an answer to that too.

Production gaging today is generally done by one of four systems: electric, air-electric, electronic or air-electronic. Perhaps this is a rather restricted view of the matter, since fixed gages are also used in production. The capabilities and the cost of the two broad groups of instruments, however, are so different that there is little if any competition between them. This discussion will be concerned with the four systems for high-volume production gaging.

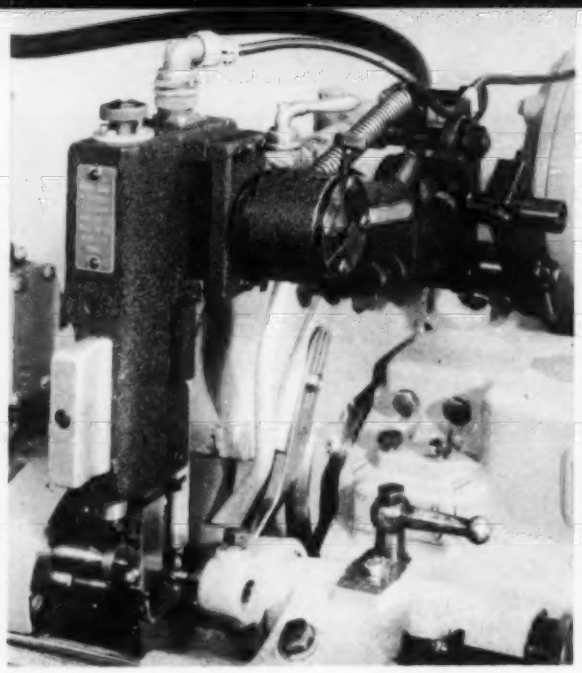
In-Process and Post-Process Gaging

The two terms, in-process and post-process, sometimes referred to as on-machine gaging and after-gaging, are used to indicate the location of the gage in relation to the machine, and its relation to the process. All four types of instruments are used for both kinds of applications. There is, however, a difference between the instrumentation and the extent of control which the gage can exercise in the two types of layout.

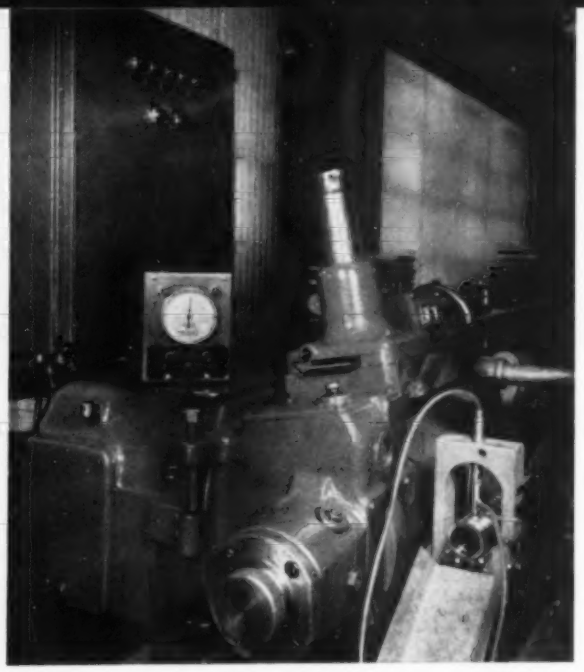
For in-process gaging, the device is located on the grinder, operates during the grinding sequence, and will automatically perform such tasks as stopping the machine and retracting the grinding wheel when the piece-part reaches finish size. It can also signal at pre-set times during the operation, and change the rate of infeed. The extent of control depends on the type of instrument selected.

Post-process gaging is performed after the operation on the piece-part has been completed. The instruments may be located near or at some distance from the grinding machine, depending on the layout of the shop. In addition to the size check on the piece-parts, the gage may classify and sort them for selective assembly. Further, the gage may relay signals to the grinding machine to compensate for machine drift, wheel wear and similar variables, beyond the simple function of stopping the machine when too many out-of-tolerance pieces have come through.

In-process gaging would appear to give better control. Operating while the piece-part is being produced, it is possible to make corrections on that piece. At the same time, this means that the gage operates under less than ideal conditions so far as coolant, temperature, vibration and chips are concerned. This factor has



Electronic caliper gage shown in riding position on work. Gage can change rate of infeed when piece-part nears finish size, stop machine when piece is within tolerance. (Photo—Brown & Sharpe)



Close-up of closed-loop air-electric centerless grinder control, showing two-jet gaging head, automation controller and cabinet for electrical controls. O.D. of inner raceways are being ground. (Photo—Moore Products Co. and Norma-Hoffman Bearing Corp.)

made in-process gaging less popular than post-process gaging, even though it is simpler and less expensive.

It is obvious, of course, that the control which can be exercised through a gage in either situation depends on the precision and the condition of the machine.

"OPEN-LOOP" and "CLOSED-LOOP" CONTROLS

Electronic systems, can be further classified as "open-loop" or "closed-loop" controls. The first term applies to set-ups where the information is used only in accepting or rejecting the product. The second refers to a set-up in which the information is automatically fed back to the grinding machine to make necessary adjustments to keep production in tolerance. An "open-loop" control system, in other words, functions like any other gage. The "closed-loop" system, on the other hand, may be designed so as to make a minute adjustment after each pass of the wheel.

With all of the talk of millionths and super-precision, however, it is worth noting that many of the worthwhile economies of closed-loop control can result from its use on roughing and semi-finishing operations where tolerances are liberal and stock removal high. On such operations wheel wear is also high and the adjustments can be made in relatively large increments, with lower costs for equipment, and greater production through the elimination of downtime.

HIGH-VOLUME PRODUCTION GAGING SYSTEMS

In grinding, electrical gaging is generally limited to cylindrical or external operations. A typical in-process setup might be described as a dial indicator or caliper gage connected through a switch to a device for stopping and retracting the grinding wheel, and possibly for changing the feed rate from fast to slow. The equipment can be wired to show the size classification—oversize, undersize, or within limits.

For post-process application, an electric system check upwards of 100 pieces per hour to accuracy on the order of .0005". It is simple to set, can be wired to sort piece-parts into good, oversized and undersized work. A simple counter can be installed and set to stop the machine when a predetermined number or percentage of scrap pieces have been produced.

Electric gaging is also the cheapest of the four production gaging systems.

Air-Electric Systems

Substitute a pneumatic gaging head in an electric system and the result is a much more versatile device which combines the better features of both of the basic systems. It is smoother in operation, less affected by minor surface irregularities, permits the checking of a greater number of dimensions on the piece-part. Because there is no wear on the gage head, the unit retains its original accuracy.

The head, or sensing device, can be varied to suit the application, including single or multiple jet rings or probes. The link between the head and the rest of the device is an air-electric switch or a series of such switches which change differing air pressures into signals which actuate other components.

One interesting variation is a cylindrical grinding gage which uses a mechanical contact for the roughing cut and switches to an air sensing device for the finish cut, because the air device provides a smoother reading on the dial indicator, which makes for easier reading by the operator.

Using the air head speeds up the gaging over the all-electric system. For post-process gaging, sorting on the order of five in-tolerance classifications plus the over-and under-size groups can be done.

Electronic Gaging Systems

Electronic gaging, for all the strides that have been made recently, is by many gaging engineers regarded as being in its infancy. It consequently is felt to have the greatest potential for increased applications, for reasons such as the following:

1. Information can be collected and processed electronically faster than by any other means.

2. It provides for more minute responses to manufacturing variations, is capable of making small adjustments. A switch or relay is either on or off, can, for instance, change feed from fast to slow at a predetermined time, but it cannot vary the infeed according to wheel wear.

3. Electronic systems offer the greatest amplification of process variables.

4. It provides rapid and automatic accumulation and calculation of data; can, in fact, take over some of the decision-making function in gaging. If the situation demands the weighing of several interrelated factors, or extremely rapid decisions, the controlling mechanism of the gage can be wired to do a better-than-human job.

In a number of ways, electronic systems in gaging are similar to centerless grinding in abrasive operations. Both are special-purpose applications, requiring relatively heavy investment in equipment. But once set up and operating, both will produce beyond the capabilities of any other similar method. And there are indications that electronic gages are now overcoming something of the price differential which has favored electric and air-electric systems.

Electronic gage installations have tended to be limited to special applications. Such gages can be set to check one dimension, ignore another. They can inspect unusual dimensions—intentional out-of-roundness, for instance. They can compensate for small variations caused by eccentricity, wheel wear and similar conditions.

They are capable of higher amplification and more selective sorting than any other gaging method. The finest tolerance which can be attained is a moot point. Ten millionths of an inch might be a good compromise figure, though finer tolerances have been point. In this range, as has been previously noted, other factors besides the capabilities of the gage become quite significant. Indications are that this is the system which will be used as still finer tolerances become feasible.

Electronic classifiers operating from the amplifier will sort product into twenty or more categories, plus over- and under-size parts, for selective assembly.

For in-process, post-process or combination applications, electronic or air-electronic gaging systems are capable of the narrowest tolerances, the greatest speeds, the greatest variety in sorting, the most delicate machine control. They can be arranged to control more than one machine. They are also the most expensive.

Air-Electronic Systems

Air-electronic gages are basically electronic gages with air gaging heads, primarily for internal applications, or where contact between the gaging head and the piece-part is undesirable. A transducer to convert variations of air pressure into electronic signals of correspondingly varying amplitude is the other fundamental change.

Such a set-up might well be preferred where it is desirable to combine a non-contact sensing device with high speed, high magnification and sorting in fine categories for selective assembly.

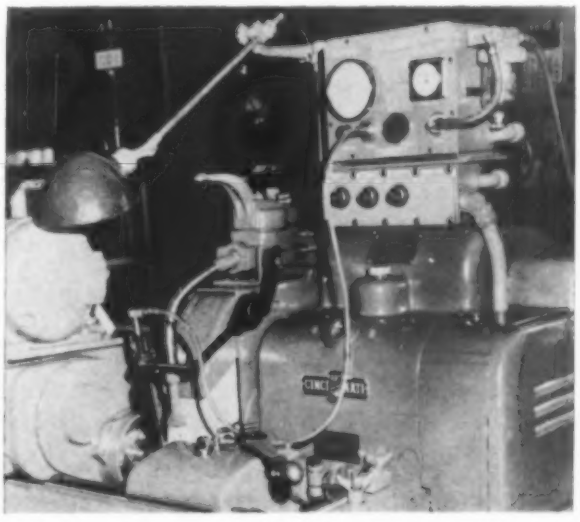
Of all the gaging systems, the electronic and air-electronic appear to have the greatest possibilities of growth in variety of applications. The development of transistorized units, for instance, appears to be a step toward package units in a lower price bracket than has previously been possible. Electronic micrometers and similar devices point up the extension of this type of control into other areas of gaging.

ULTRASONIC GAGING

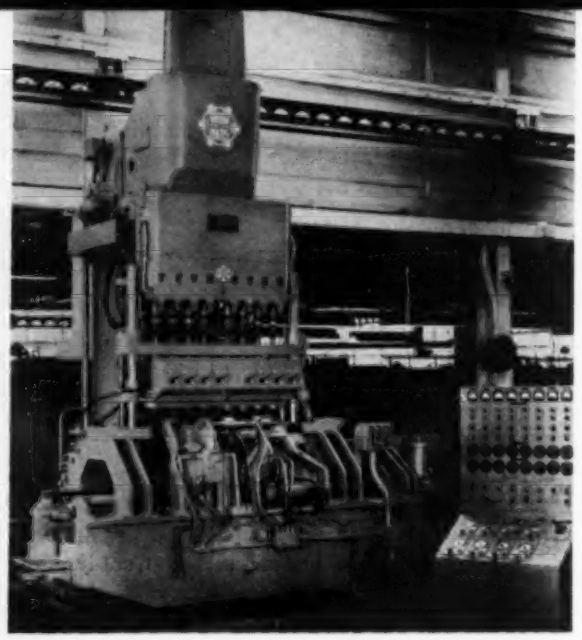
Ultrasonic gaging may be described in laymens' language as gaging by means of the distance traveled by sound waves through a material. In practice, the sound waves go through the material and are reflected back, and the "travel time" of the sound wave indicates the thickness of the material.

This method is finding its greatest use in measuring the thickness of aluminum, stainless steel, and other sheet materials, generally replacing applications where

Electronic micrometer gives direct measurements to the fifth decimal place. It is a screw-thread measuring instrument—not a comparator. (Photo—J. W. Dice)



Caliper gage set up to switch from mechanical pick-up for roughing to air pick-up for finishing. Air is smoother, makes for easier reading of the dial. (Photo—Federal Products Corporation)



Package air-electric unit applied to a precision honing machine to provide automatic machine control with in-process gaging. Cylinder bores of automotive engines are honed to finish size and checked to within a few tenths during the process. (Photo—Pratt & Whitney Company, Inc.)

deep-throated micrometers were used. Its accuracy is considered to be equal to the micrometer, and it is better because it is possible to take many more readings in the same time and there is no concern about difference of interpretation or differences of pressure.

It is obvious that applications must be limited to sound-conducting materials. It has no usefulness on paper, cloth, or other sound-absorbent materials.

Ultrasonic gaging gains another advantage in that it is necessary to contact only one surface of the piece-part. Thus it can be used on tubes, cylinders, cones, or other places where access to a second surface is difficult. It also can be used while the piece-part is still on the machine.

In a typical application the workpiece might receive a sort of spot-checking while it was still on the machine. Then, after it was removed it could be given a thorough going-over.

This method is said to give accurate results on poor surfaces. Applications are generally manual or semi-automatic. On some of the latter applications the number of contacts per minute is approximately 700, obviously much faster than any manual device.

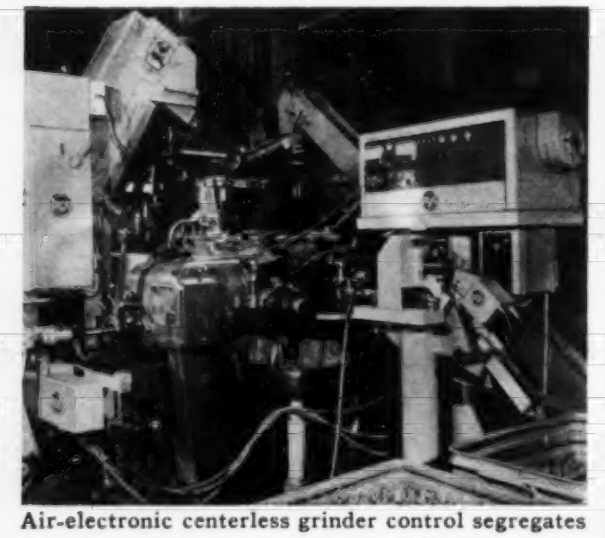
Operating an ultrasonic gage requires little skill. The operator merely holds a transducer probe to the surface of the material and notes the location of an indicating "pip" on a scale. Or, the inspector may slide the probe across the surface and notice the variations on the screen. One of the most useful areas of application is in in-process or what might be called pre-process gaging. Thus an operator might well check his material to see the approximate depth of the final cut. Or, a grinder hand who found that a tube was heavy on one side could check it slightly off center to favor that side and thus come out with an acceptable finished piece.

Thickness resonance in the material is indicated by a vertical line on the cathode-ray tube. Calibrated transparent scales placed in front of the tube enable the operator to read the lines directly in terms of thickness.

Because the speed of sound varies in differing materials, it is necessary to use different scales if direct readings are to be made. Instruments are usually calibrated on steel, but may be used for other materials if allowance can be made for the difference in conductivity of the materials and if the requirements for precision are not too tight.

OPTICAL GAGING

What has been considered previously has been primarily dimensional gaging. This involves either the direct reading of a dimension in terms of some unit of measurement, or else the comparison of the actual measurement with an ideal or nominal measurement and some recording of the variation from the ideal. The optical method can be used for this type of gaging; however, in most shops it is more likely to be used for the gaging of irregular



Air-electronic centerless grinder control segregates parts if out of tolerance. Can be applied on through-feed, plunge and crush types of centerless grinders, as well as internal and surface grinders. (Photo—Radio Corporation of America)

Ultrasonic resonance gage used to test the wall thickness of the stainless steel nose cone of the first Explorer. (Photo—Branson Instruments)

The Fringecount® micrometer combines optical, mechanical and electronic principles to measure directly to millionths, in controlled environment, using the wave-length of light from a krypton lamp as the standard. (Photo—Link Aviation, Inc.)

Measurement checks every half-degree around the periphery of this cam can be done by optical gaging in less than a minute, formerly required several hours. (Photo—Eastman Kodak Company)

outlines, angles, or other applications where it is possible at one time to check dimensions and other attributes of the piece-part, which would either take longer by some other means or could not be checked at all.

The principle of the optical comparator is very old. The piece-part is placed in front of the light source and its enlarged shadow is projected onto some kind of screen. In practice the amount of light and the placement of the holder or staging device are very accurately controlled, and the image is projected by means of a series of prisms and mirrors so that it appears on a ground glass screen in front of the operator. The amount of magnification—10X, 20X, 25X, 31¼X, 50X, 62½X, and 100X—are very precisely calculated.

A plain ground glass screen can be used to observe the image of any part to be reproduced. The outline of the image may be traced upon the ground glass, using a sharp, hard pencil. An outline can be followed easily to 0.02" on the screen and with care to within 0.01". It will be seen that at 50X magnification with a departure of 0.02" from the image outline, this tracing will be accurate to ±0.0004" on the part projected.

The advantages of this method are:

1. The object is not subjected to pressure by mechanical devices, and therefore the measurements are free from errors due to deformation.
2. Areas of the object not accessible to other methods of measurement are made available.
3. Objects considerably larger in size than the field of the projector can be measured accurately.

Probably the outstanding advantage of an optical comparator is its ability to check so many facets of the piece-part simultaneously. With an image drawn on a ground glass screen or on translucent paper which is attached to the screen, it is possible to add tolerance lines which will show whether dimensions are within limits and at the same time to indicate quite accurately angles, slopes, or contours which are difficult if not impossible to check by other means. Doing the same checking job by other means might well involve a very elaborate setup, or in many cases would not even be possible.

CONCLUSION

The original intent of this series of articles on gaging was to provide users and potential users of gages—this includes practically every manufacturer, machine shop and tool room in the country—with enough background on the subject to enable him to get the most out of his present equipment and to spend future gaging dollars to better advantage. In the process there have come up a number of worthwhile subjects which will be material for articles in GRINDING and FINISHING.

The assistance of many gage manufacturers is gratefully acknowledged. A list of those who have assisted is attached. A bibliography of books and articles on the subject, together with a list of manufacturers' catalogs and bulletins, is also appended.
(See pages 52-53.)

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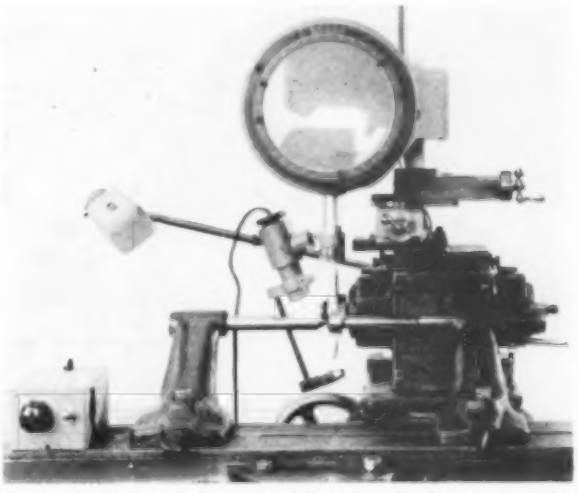

Selecting the right magnification is important in optical gaging. At 10X, a tolerance of .0005" appears as .005", just recognizable with the unaided eye. At 20X, it appears as .010", easily recognizable. (Photo—Stocker & Yale)

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(Editors' Note: This is the final article of a series that began in August. Reprints of the series will be available at nominal cost, probably about Dec. 1.

Acknowledgments

The assistance of the following companies in gaging and related fields is gratefully acknowledged.

Acme Scientific Company
Airborne Instruments Laboratory
American Diamond Tool & Gauge Co.
Besly-Welles Corporation
Branson Instruments, Inc.

Brown & Sharpe Mfg. Co.
Cargill Detroit Corporation
The Cincinnati Milling Machine Co.
Collins Microflat Company
Columbia International Corp.

Crane Packing Company
Custom Scientific Instruments, Inc.
Dearborn Gage Company
J. W. Dice Company
The DoAll Company

Eastman Kodak Company
Edmund Scientific Company
Edroy Products Company
Engis Equipment Company
Electro-Autosizing Machine Corp.

Ex-Cell-O Corp. (Greenville Plant)
Federal Products Corporation
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Stebar Company
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Swiss Precision Tool Company
Taft-Peirce Mfg. Company
Taper Micrometer Corporation
Tatra Tool Company
Testing Machines Inc.

Threadwell Tap & Die Company
The Van Keuren Company
Warner & Swasey Company
Winter Brothers Company

A brief list of bulletins, catalogs and other publications containing information of general interest concerning gages:

Airborne Instruments Laboratory ....MICROtrol® and other Application Engineering Handbooks (296)

Branson Instruments, Inc.
.....Vidigage® Ultrasonic Gages (297)

Brown & Sharpe Mfg. Co. .....Electronic Production Measuring and Inspecting Equipment (298)

The DoAll Company ..Facts of Gage Block Life (299)

Instruction Manual—Micro-Step Gaging System (300)

.....The Story of Measurement (301)

Eastman Kodak Company and
Optical Gaging Products, Inc.
.....Optical Gaging's Value to You (301)

Fonda Gage Company, Inc.
Federal Products Corporation
.....Automation Gaging Systems (303)

.....Ultra-finish Gage Blocks (304)

Moore Products Co.
.....Pneumatic Comparator Gages (305)
(Bulletin 8008)

Pratt & Whitney Company, Inc. ..Gages—No. 12 (306)

The L. S. Starrett Company
.....General Catalog No. 27 (307)
Bulletin No. 416 (308)

Threadwell Tap & Die Co. ..Gages—Catalog G55 (309)

The Van Keuren Co.
.....Catalog and Handbook No. 36 (310)

Among the company publications in the field are these: "Methods of Measurement" from Federal Products; "Report" from Cincinnati Milling; "The Sheffielder" of The Sheffield Corporation and Standard Gage's "Gaging Newsette."

Two U.S. government publications of interest are:

Gage Blanks—A Recorded Voluntary Standard of the Trade. Commercial Standard CS8-51.

Gage Blocks, Attachments and Accessories, Federal Specification GGG-G-15, June 7, 1956.

*Numbers in parentheses (296-310 inclusive) are keyed to the READER SERVICE CARD, p. 65.

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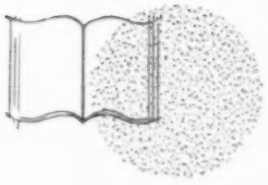


Literature

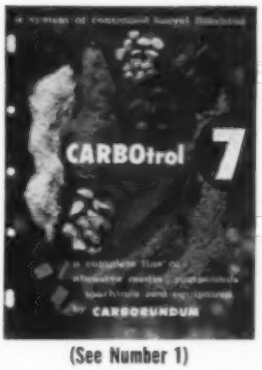
1. Controlled Barrel Finishing. A seven-point system for scientifically controlled barrel finishing is detailed in "CARBOtrol 7", a 36-page, multi-colored booklet Covering size and type of media, ratio of media to parts, load height, water, compounds, barrel speeds, and tumbling time, the booklet describes a complete line of tumbling media, barrel finishing compounds and precision barrel finishing machines and equipment for the full range of tumbling operations. Carborundum Co., Niagara, N.Y.

2. Micro-Polish Units. Eight page brochure describes Murray-Way Micro-Polish Units for grinding and polishing coils, blanks and sheets in all materials. New brochure discusses features and advantages of Micro-Polish Units and gives detailed engineering specifications. Photographs and descriptions of auxiliary equipment and many variations and combinations of Micro-Polish Units are also included. Murray-Way Corp., Birmingham, Mich.

3. New Universal Grinding Machine. Design features, applications, specifications and accessories of new Heald Model 273A Universal Internal Grinding Machine are described in an eight page illustrated brochure. The Model 273A, a high precision grinder for internal, external and rotory surface grinding, will grind straight or taper bores outside diameters flat, convex or concave surfaces. Developed specifically to fill the need for a low cost, high precision grinder its best application is internal grinding of a variety of single parts or small lot production. The Heald Machine Co., Worcester, Mass.

4. Abrasive Belt Grinder. Features and specifications of the Model 760 and Model 562 Burr-King Abrasive Belt Grinders are described in a four page brochure. These light bench type machines include safety guards, adjustable work rests and back-up and positive belt tension adjustment. Operational costs are held to minimum, belt costs are comparatively low, changing belts requires only seconds, surface speed and wheel diameters remain constant. Burr-King Mfg. Co., El Monte, Calif.

5. Wet Blasting Units Price List. Complete standard equipment and accessories price list for all wet blasting units manufactured by Pressure Blast Mfg. Co. is now available. List includes costs of all six stainless steel construction models, itemized rates for standard, manually operated and high velocity units and automatic attachments. Pressure Blasting Mfg. Co., Manchester, Conn.



(See Number 1)

(See Number 2)

(See Number 3)

6. Fluid Filter Elements. Applications and charactertistics of series 2200 Microbon Ribbon fluid filter elements are described in a four page brochure by the Bendix Filter Div. New brochure, illustrated with photographs, drawings, curves and tables, discusses the application of Microbon elements in various liquids, including hydraulic oil, lubricating oil, water, kerosene, as well as many others. Filtration principles and cleaning techniques of this filter media are described and illustrated in details, and representative flow data is presented in a series of graphs. Also listed are standard sizes and tolerances available and a group of drawings illustrate typical means of installation. Bendix Filter Division of Bendix Aviation Corp., Madison Heights, Mich.

7. Vices, Chucks and Dividing Heads. Illustrated and described are a full line of vices, dividing heads and attachments, lathes and magnetic chucks, demagnetizers and rectifiers. L-W Chuck Co., Toledo, Ohio.

8. Preformed Tumbling Media. Sizes, bonds, benefits, and prices of preformed tumbling media manufactured by Fortune Industries, Inc. are described in a four page pamphlet. Three basic shapes are covered with such benefits as rapid deburring, prevention of lodging, range of availability and value of barrel finishing described. Fortune Industries, Inc., Chelsea, Mich.

(See Number 6)

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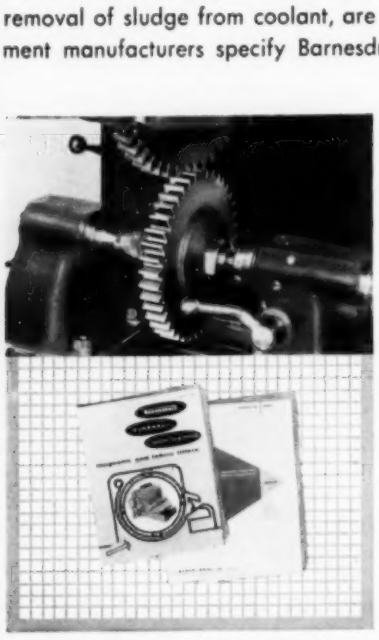

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FREE LITERATURE *continued*

9. Rotary Automatic Polishing and Buffing Machines. Illustrated and described in a two-color 12 page bulletin are the Acme Rotary Automatic Polishing and Buffing Machines. These machines and their accessories provide for polishing, buffing, deburring, wire brushing, and micro-finishing with set-up wheels, buffs, brushes or abrasive belts. Indexing, continuous and combination types are illustrated. Acme Mfg Co., Detroit, Mich.

10. Standard Shapes and Sizes of Grinding Wheels. Printed by the Grinding Wheel Institute, this 74 page booklet covers use of classification, and standard shape types and sizes of all grinding wheels. The recommendations were written by a standing committee which covered two basic areas. The first was classification by use, covering cutting off to tool grinding. The second was standard shape type and sizes from type 1, straight wheels, to type 27, depressed center wheels. Long the most important standard book in the grinding field this R45-57 should be in every company file where grinding is performed.

Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio.

11. Checks Ball Bearings. Four page folder describes the Barden SmoothRator, an electronic testor that predicts performance qualities of oil lubricated precision ball bearings up to 1" O.D. By revealing vibrational charactertistics of bearings, the machine detects performance aspects not measurable by other types of testers. On the production line, the device screens bearings likely to cause rejection of completed components, separates damaged bearings from those which maybe cleaned and re-used, or locates operations responsible for dirt, contamination or damaged bearings. It can be set up in 10 or 15 minutes and tests 60 to 100 bearings per hour. Barden Corp., Danbury, Conn.

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MICRO-FINISHING . . .

(See Number 9)

12. The Abrasive Workshop. A magazine by the Carborundum Co. features a treatment of abrasive belt roll grinding on submarine periscopes. This tough job of

grinding and finishing long tubes of corrosion-resistant steel, 7½" in diameter and approximately 34 feet long, is done in less than ½ the time required by traditional methods, and a better finish is developed. The Carborundum Co., Niagara Falls, N.Y.

13. New Vibrator. Four page bulletin describes new 3 hp Model 1016E Vibrator for precision finishing of metal, plastic or wooden parts. Covered is general information, construction features and detailed specifications, including standard equipment. Lord Chemical Corp., York, Penna.

14. Grinders Available. Micromatic Hone Corp. announces the availability of Jones-Shipman universal toolroom, surface, precision and tool and cutter grinders in a four page bulletin. The four types of grinders are described and illustrated Micromatic Hone Corp., Detroit, Mich.

15. Thread Measuring Wire Carriers. Described in a four page bulletin is the Standard Gage Co. Thread Measuring Wire Carriers. Using the widely accepted 3-wire method this equipment is designed for up to ¾" for micrometers and 1" for measuring machines. Included is a detailed description with illustrations, chart of threads which can be measured and descriptions of sets with prices. Standard Gage Co., Poughkeepsie, N.Y.

16. Portable Rotary Screen Classifier. Two page flier covers the Almco Portable Rotary Screen Media Classifier. Illustrated is the machine and the feature of segregating three sizes of media simultaneously. The Supersheen classifier has a 6,000 lb. per hour capacity and the three screen sections are interchangeable for grading a complete range of media sizes. Queen Products Division, King Seely Co., Albert Lea, Minn.

17. Tool Engineers Handbook. The Handbook, Second Edition, is a technical reference work published by the American Society of Tool Engineers, Detroit, as an aid to chief engineers, planning heads, manufacturing executives and others connected with manufacturing industries. Containing the latest technical data in processes, planning, estimating, machines and tool design, it is the results of twenty-six industrial committees from throughout the nation.

(See Number 19)

18. Vacuum Equipment. New four page folder describes how to use Invincible Vacuum Equipment to reclaim, process and convey scores of materials. Included

3 STEPS TO THE TOP BUY...

ACTION DIAMOND WHEELS

HONES—MOUNTED POINTS

1 YOU TELL Action Diamond what you want your diamond wheel to do.
2 YOU USE the wheel Action Diamond designs and builds to do your particular job.
3 YOU GET precisely the right diamond wheel in shape, grit and bond to assure the accurate, low cost production that only a custom-built Action Diamond wheel can deliver.
JETALINE DIAMOND WHEEL
RoBot Resin DIAMOND WHEEL

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Your custom built Action Diamond wheel has the same price tag as any diamond wheel of comparable specifications. The extra production per wheel delivered is all profit for you. Call Action in, by letter or 'phone. Show us your grinding problem. You are guaranteed an expert analysis of your diamond wheel requirements at no cost, no obligation.

At ACTION . . . The Right Wheel For Your Material

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JETALINE DIAMOND WHEELS	• for conventional wet grinding. • for electrolytic grinding.
JETALINE METAL BONDED ABRASIVE WHEELS	• for electrolytic grinding.

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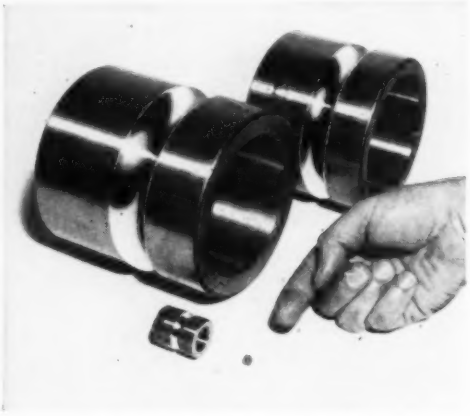
WHY MICROHONE* YOUR CRITICAL ANTI-FRICTION BEARING SURFACES? BECAUSE...

Bearing loads and speeds, in common use today, demand critical bearing surfaces that are accurate, have correct geometry and proper surface finish. Also, the process that generates these surfaces must keep production costs to a minimum.

MICROHONING INCREASES PRODUCTION

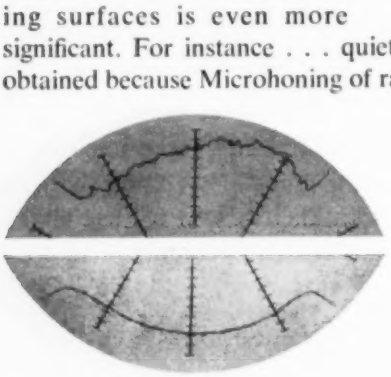
Microhoning is the first successful method for automatic processing and handling of raceway rings on multiple machines. It increases production several times over output of former methods.



Raceways of inner and outer rings for ball diameters ranging from .062" to 1.50" are currently being Microhoned.

MICROHONING IMPROVES BEARINGS

The ability of Microhoning to greatly improve the functional characteristics of critical bearing surfaces is even more significant. For instance . . . quieter-running, longer-life ball bearings are obtained because Microhoning of races assures:



Comparative Talyrond charts—each division of radial lines equals 50 millionths of an inch. Top: raceway curvature of a finished, unhoned precision bearing. Bottom: curvature of Microhoned raceway.

1 Improved concentricity between raceway and bore;

2 Removal of humps in raceway and trueing of plane of track;

3 Correct track curvature for greater contact with balls;

4 Simultaneous improvement of accuracy and surface finish.

Critical checking on precision instruments, and comparative performance studies have convinced many bearing makers and users that Microhoned bearings run smoother, quieter, and longer than those processed by any other method.

**Registered U.S. Pat. Off.*

For further information, write to:

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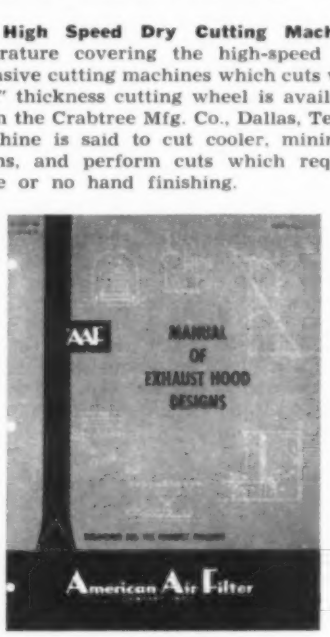
FREE LITERATURE *continued*

are such typical applications as pneumatic conveying of plastic pellets, cleaning boiler tubes and removing used coolant from machine sumps. Also outlined is the range of standard models and illustrations of special units for use in hazardous applications. Invincible Vacuum Cleaner Mfg. Co., Dover, Ohio.

19. Gages. Snap gages, bench comparators, depth gages, tooling balls, caliper gages, flush pin gages, sheet thickness gages, dial pin gages, recess gages, shallow hole gages, bore gages and production inspection kits are illustrated and described in an eight page bulletin. Description includes range, features and operating instructions. Reliant Gage & Supply Co., South Gate, Calif.

20. Exhaust Hoods. New 28 page manual of Exhaust Hood designs for the foundry industry has been prepared to illustrate various exhaust hoods designed for many different operations common to the foundry. The bulletin contains 46 actual installation photographs which illustrate the use of exhaust hoods in foundry shakouts, melting furnaces, grinding and abrasive sawing, swing frame grinding, abrasive cleaning and tumbling, sand handling and conditioning. American Air Filter Co., Louisville, Kentucky.

21. High Speed Dry Cutting Machine. Literature covering the high-speed dry abrasive cutting machines which cuts with 1/32" thickness cutting wheel is available from the Crabtree Mfg. Co., Dallas, Texas. Machine is said to cut cooler, minimize burns, and perform cuts which require little or no hand finishing.



(See Number 20)

22. Dymond Cut Wheel Dresser. Bulletin covers versatile little wheel dresser which gives substantial wheel life savings and increased life and performance of cutting tools. Dresser is especially suitable for dressing and truing plate mounted and pedestal type grinding wheels. Bearing life is increased by proper dressing of wheel giving true balance, which is also a safety feature. Last Word Sales Co., Detroit, Mich.

23. Flexible Finishing of Metal. Slashed version of the Grind-O-Flex flexible grinding wheel has recently been announced in a catalog by Merit Products,

Inc. The abrasive cloth "leaves" are cut into thin strips. As the wheel rotates the "abrasive fingers" mold to irregular shapes and gets down into places which formerly could only be finished by hand. Wheel sizes are 14" and 16" diameters and widths are available from 3" to 60". Merit Products, Inc., Los Angeles, Calif.

24. Drill Grinder. New Farrel-Sellers 1 G-A Drill Grinder is described in their bulletin 4104. The grinder will grind either straight or tapered shank, right-hand, 2-lip twist drills in sizes from No. 70 to 1" diameter, to any included angle of point from 60 to 150 degrees. New chuck arrangement, one of the many features of this grinder, is easy to load and provides a smooth, accurate method of grinding. Farrel-Birmingham Co., Inc., Consolidated Machine Tool Div. Rochester, N.Y.

25. High Performance Cleaners. Six CeCOR high performance cleaners are described in literature by Coolant Equipment Corp. Included in this literature is a full description of the new portable centrifugal filter. This cleaner filters metal chips, fine suspensions and sludge from coolant and lubricating oil and is designed to service every machine tool in the plant. High vacuum, up to 275" water, produced in the tank body of the CeCOR Model 20T-NS Coolant Cleaner draws the entire contents of the machine tool sump through the suction hose into a centrifugal filter basket. Coolant Equipment Corp., Verona, Wisc.

26. Compact, High Production Honer Complete bulletin covers new Model 244 Barnes Drill Honing Machine. Outstanding features of the new machine include compact design, simplicity of controls, Plugmatic bore-to-bore sizing, electric hone expansion and dial control of stroke length. Barnes Drill Co., Rockford, Ill.

27. Soluble Oil for Soft Alloys. Two color bulletin describes Shear-Speed Chemical Products' AL-HD soluble cutting oil which is formulated specifically to provide maximum stability in cutting of soft alloys. This high lubricity oil is said to have demonstrated material savings through longer tool life, less down time and fewer sharpenings and dressings. Shear-Speed Chemical Products. Detroit, Mich.

28. Direct Dividing Heads. Literature covering the direct dividing heads now available for all models of L-W Chuck dividing heads describes how the new models with direct indexing permit changing from conventional indexing to direct indexing in less than a minute. A 24-slotted plate is standard equipment with direct indexing models. Machine blanks can also be furnished.

30. New Honing Machine. Bulletin on new honing machine designed for production runs, toolroom work and salvage operations covers spindle speeds, features and optional equipment. The machine which is priced within the reach of shops heretofore deprived of automatic honing, has been announced by Superior Hone Corp., Elkhart, Ind.

31. Centrifuge for Coolant Clarifying. Described and illustrated in a two page flier is the Lavin Centrifuge. Designed for coolant clarifying for such operations as grinding, honing, lapping, polishing and cutting machines, it is said to increase production, improve finish, cut costs and increase wheel, tool and coolant life. A. M. Lavin Machine Works, Hatboro, Pa.

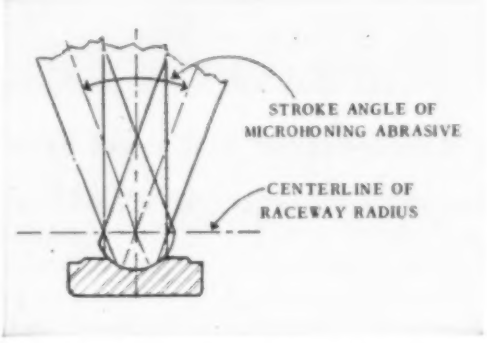
HOW MICROHONING* OF CRITICAL BEARING SURFACES ASSURES QUIETER-RUNNING, LONGER-LIFE

Because Microhoning is the first successful method for automatic processing and handling of anti-friction raceway rings on multiple spindle machines, production is several times higher than former methods.

In addition, here's how application of basic Microhoning principles (a combination of motions, low-velocity abrading, controlled pressure, float in tool) improve the functional characteristics of bearings: concentricity, track curvature, waviness, accuracy, surface finish.

Typical five-spindle machines for Microhoning bearing raceway. Typical production: bring high-band reading (Wavecometer) of raceway waviness below one microinch, rms . . . five rings in a 20-second cycle.

Tools are positioned on an oscillating bridge so that abrasive sticks pivot about the centerline of raceway arc to generate a true radius. As rings rotate, irregularities are removed from track leaving a clean surface that is free of smeared or deformed metal. During final seconds of Microhoning cycle, speed of oscillation is automatically reduced to generate a lay pattern that runs circumferentially around the track.



Because abrasive stick pivots about centerline of raceway while rings are rotating, Microhoning improves raceway curvature, waviness, surface roughness and lay.

Microhoning technique can also be applied to raceways of cylindrical roller, tapered roller, needle, thrust and self-aligning bearings . . . also, other critical bearing surfaces.

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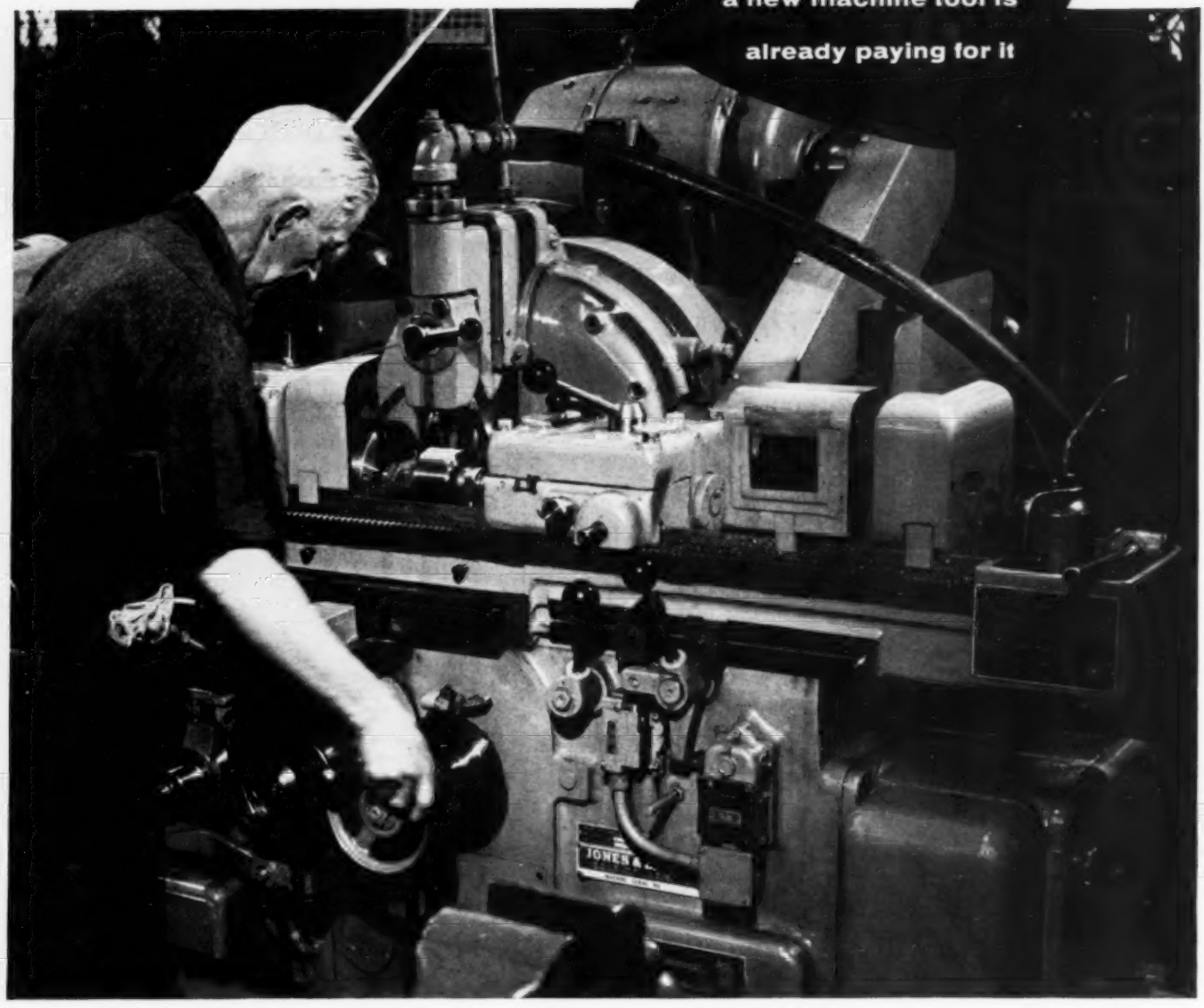
JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it



Close Tolerance Tool Room Work on an Automatic machine with Universal Application

A customer writes: "The versatility of Jones & Lamson Thread Grinders is scarcely tested in the conventional production of hobs, taps, gages and threaded parts. In our toolroom, using the thread grinder as a basis for 'Rube Goldberg' development, we have produced precision racks, small form-profiled milling cutters, oil grooves and grinding wheel crushers.

"While serving the purpose as a necessary piece of equipment, this machine also provides a means by which many additional production problems can be explored and tested. Applying the thread grinder to toolroom problems is putting the best foot forward for quickly producing accurate and dependable shop accessories."

* * *

Write for catalog 600. Jones & Lamson Machine Company, 531 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

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This standard mounted wheel reduced production costs 40% for a major airline

When breakage and excessive wear of mounted wheels threatened important production operations for one of the world's largest airline companies, CARBORUNDUM solved the problem with its *standard* A24 shape AA60-R-V60 mounted wheels. Preliminary tests proved top cutting action *without breakage* and 40% savings in wheel costs. The result—complete customer satisfaction and establishment of the wheel as a *"no substitute"* item for this operation.

This record is typical of results being obtained on all kinds of difficult grinding operations with the CARBORUNDUM line of NATIONAL STANDARDS. Here's how you can get the results *you* want—*fast.* Contact your local CARBORUNDUM distributor. He carries a complete stock of pre-tested NATIONAL STANDARDS for every grinding application.

Specify "Job-Engineered" NATIONAL STANDARDS by

CARBORUNDUM®

WRITE FOR YOUR CATALOG OF NATIONAL STANDARDS, Form A-1489 and prove to yourself how "Standards" can solve many of your abrasive problems. Send your request to The Carborundum Company, Dept. G 81-98, Niagara Falls, N.Y.

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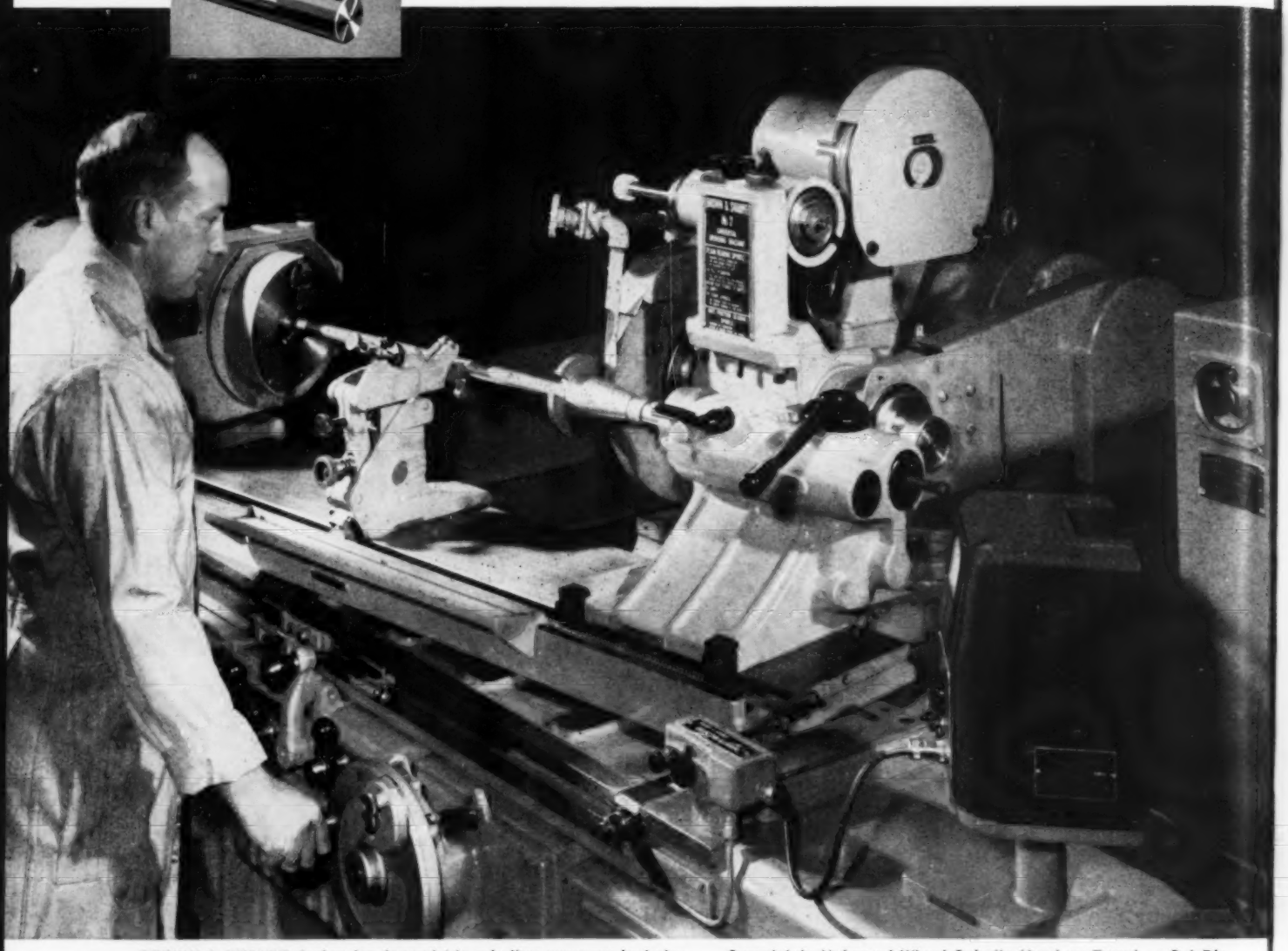
TO HELP YOU GRIND MORE FOR LESS



BROWN & SHARPE design for dependable grinding economy includes . . . Completely Universal Wheel Spindle Head on Turret — Set Diamond Wheel-truing Attachment for Internal Grinding — Power and Hand Cross Feed in Both Directions — Power Cross Feed Continuous to Finish Diameter Setting — Positive Stop for both Internal and External Grinding — ELECTRALIGN for Instant Table Alignment.

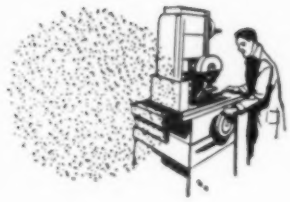
Universals that deliver more grinding minutes per man-hour - save up to 75% in floor-to-floor time

Brown & Sharpe Universal Grinding Machines provide many exclusive advantages that simplify the operator's task, save set-up time, and speed up non-grinding motions. Job time saved often totals 75% or more.

Only Brown & Sharpe offers the ELECTRALIGN®, the original electronic indicator for swivel table alignment — the only device that permits instant alignment to 10 millionths per inch of workpiece with a single setting. The operator is fully relieved of the need for calculations. No delay for repeated gaging and adjustment, and no scrap.

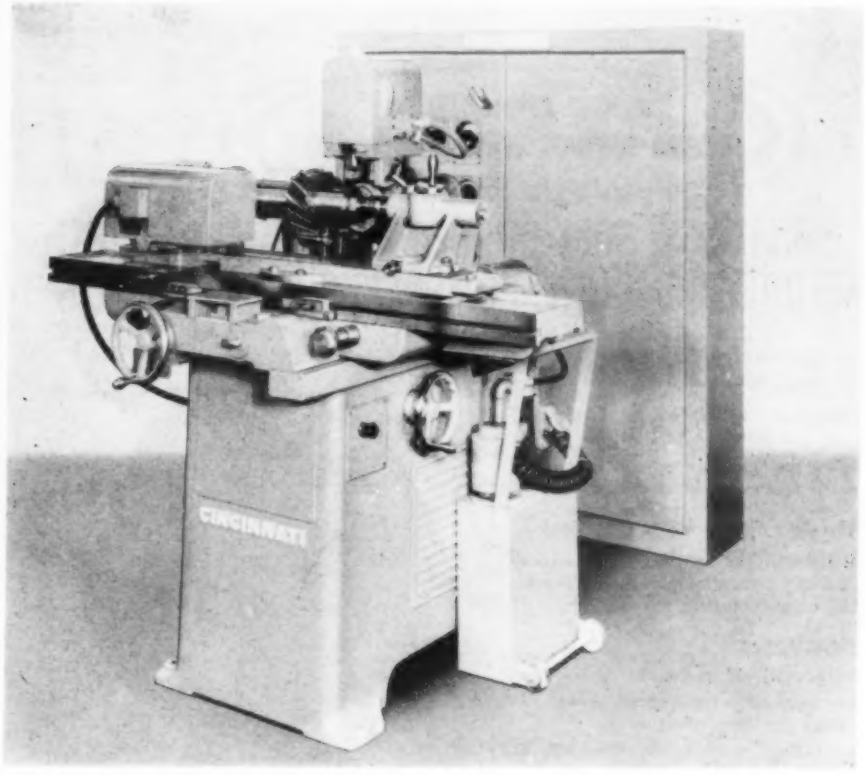
For top returns in cost-reduction, you need all the extra advantages of Brown & Sharpe design when you choose grinding machines for toolroom, prototype operations, or for production grinding. Why settle for less? Four machine sizes. For details, write: Machine Tool Division, Brown & Sharpe Mfg. Co., Providence 1, Rhode Island.

Brown & Sharpe PRECISION CENTER



Equipment and Materials

Automatic Cutter Grinder Supplements Production Milling



After set-up, grinder sharpens identical cutters without attention from operator.

A new automatic cutter grinder developed by Cincinnati Milling is simple and automatic enough that an operator can sharpen his own cutters while maintaining production of the mill.

Once the grinder is set up, it will sharpen identical cutters without attention from the operator. Consistency of grinds from cutter to cutter increases number of pieces machined between sharpenings. Either right or left hand plain or stagger-tooth cutters can be ground.

One of the outstanding cost and time-saving advantages claimed for the machine is its automatic grinding wheel truing. The operator need only decide how many teeth he wishes to grind between truings and how many passes of the diamond will be required. He sets these numbers on the control panel.

At the pre-set intervals, the diamond advances .001" per pass and makes as many passes as have been programmed. For each .001" advance of the truing attachment, the saddle pickfeeds .001" to compensate.

The saddle, operating on ball tracks, can be dial-set to pickfeed between .00025" and .005" in increments of .00025". Both rough and finish pickfeeding can be set individually anywhere within this range.

A variable torque motor indexes the cutter into proper position against the toothrest. A second torque setting, preselected on the control panel, establishes the proper pressure between cutter tooth and toothrest for smooth feed of the helix during the grind. A limit switch indexes the cutter at the end of each tooth grind.

To assure concentricity, the Cincinnati Automatic Cutter Grinder is equipped with a contour to permit 180° rotation of cutter after the first rough grind revolution. By this method the effects of tool wear are minimized. The high degree of concentricity plus the uniformity achieved by the automatic cycle contribute greatly to long tool life.

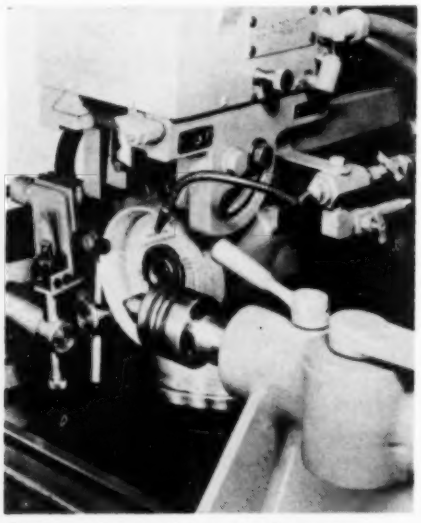
Eight counters on the machine panel permit quick selection of the desired cycle. The counters program: Number of rough grinding revolutions of cutter, number of finish revolutions, number of cutter teeth, 180° rotation for concentricity, number of teeth for roughing pickfeed, finish pickfeed, teeth

For more information on the equipment and material described in this section, use the Reader Service cards on Page 65. Circle the number on the card which corresponds to the number following the write-up you are interested in.

ground between wheel truings, number of truing passes.

Selector switches on the panel control: Direction of grinding wheel rotation, coolant, manual or automatic operation, for helical or stagger-tooth and setting for either straight or cup wheels. Lights on the control panel immediately indicate the portion of the cycle that is active at any time.

The automatic cycle can be interrupted at any time and then resumed at the same point.



Automatic truing attachment

Cincinnati Milling Machine Company, Grinding Machine Division, Cincinnati 9, Ohio.

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Surface Grinder Attachment Converts for ID, OD and Centerless

Surface grinding machine attachment, which converts any surface grinder into a precision OD, ID and centerless grinder obtains exceptional speeds and unconventional cuts with corresponding savings on both occasional jobs and production runs. Rough turning operations have been eliminated in many cases. For centerless grinding the work merely rests on a motor driven regulating roller. For plunge grinding, a hold down bracket is inserted into the unit in seconds, no chucking nor indicating is required.

Unison Corp., Royal Oak, Mich.

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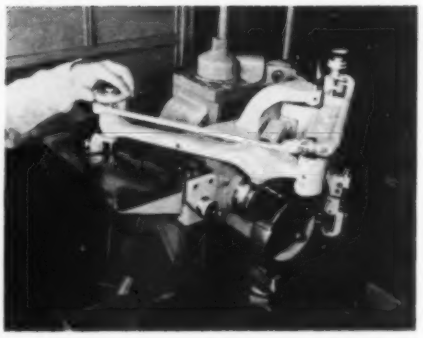
Wheel Forming for Surface Grinders

New Model 5 "Diaform" Wheel Forming Attachments for toolroom surface grinders is designed for permanent mounting on the machine's spindle head. Permanent mounting is said to provide instant availability to form-true or re-true the grinding wheel while it will not interfere with the grinding operation. The operator simply traverses a tracer over the profile of an easily made template and the path of the tracer is transmitted at 5:1 or 10:1 reduction ratio. The entire job can be performed in minutes and the wheel is form-trued accurate to a few ten thousandths of an inch.

Model 5 is equipped with a swiveling diamond spindle that is said to equal-



ize wear and greatly increase the accurate life of the diamonds. The diamond spindle is a tandem type with one diamond for semi-finishing and a second for finishing.

Pratt Whitney Co., Inc., West Hartford, Connecticut.

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A NEW APPROACH TO BIGGER SAVINGS IN METALWORKING

MULTI-USE, SOFT RUBBER BONDED ABRASIVES
THE ONLY COMPLETE, COMPREHENSIVE STOCK LINE!

— *Achieving* —

A Unique, Rubber-and-Abrasive Action

Simultaneous BURRING • FINISHING
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bridging the gap between the grind and buff, *frequently in one operation*

Wheels • Sticks • Rods • Blocks

JOB-MATCHED to your machine and manual operations. Exceptionally suited to automation production.

DISCOVER:

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Silicon Carbide and Aluminum Oxide Grains—grades extra fine to extra coarse—in soft, firm and tough rubber binders.

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DRAW ON YOUR DEALER'S STOCK OR ON OUR COMPLETE FACTORY STOCK.

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Grinding and Finishing

NOVEMBER, 1959

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Grinding and Finishing

NOVEMBER, 1959

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Please have information sent me on all items I have encircled.

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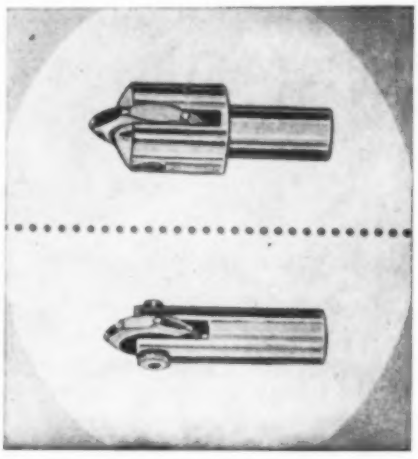
New Grinding Wheel Dresser Never Needs Resetting

A new "Economy" grinding wheel dresser increases grinding efficiency by lowering grinding heat at the area of contact.

Small, elongated and especially selected diamonds are mounted in a patented steel matrix. The metal mount has the same coefficient of expansion as the diamond, and bonds to it.

The special shape and mounting of the diamond keep the dresser sharp over its entire life. These dressers never



require resetting. In this respect they are similar to throw-away tools. The same contact area of diamond is presented to the grinding wheel through the life of the tool.

A few standard dressing tools can be used on a variety of different machines.

The resulting reduction in inventory and efficiency in grinding bring about substantial reductions in tool and grinding wheel costs.

Precision Diamond Tool Company, Elgin, Illinois.

Use postpaid card. Circle No. 35

Precision Finishing Small Parts

New Techline Roll Finishing machine is designed as a low-cost unit for small parts such as screws, washers, delicate gears and precision instruments. Using octagonal-shaped barrels, the machine is available in six basic models and larger special sizes. Barrels are set on rollers powered by ½ HP 110-V drive. Drive is enclosed in a molded fiber glass

Planning To Reduce Costs?

. . . on high speed grinding and finishing jobs

Then Check On!

HOFFMAN

"Narrow-Kerf"

DIAMOND BITS

Hoffman "Narrow Kerf"* Bits are currently in use for countless high speed operations on such materials as glass, marble, granite, ceramic, zac, monofrax pyroceram, etc.

If low production costs and outstanding performance are important . . . then it will pay you to investigate the savings possible with Hoffman "Narrow Kerf"* Bits, available with Diamond Impregnated or Diamond Surface Set cutting faces, these bits will help you establish new standards of production and quality on items of the hardest materials known.

Actual performance records show one instance where Hoffman Bits are drilling 16,000 holes per bit on a glass job. On Ceramic Lamp Base drilling operation, Hoffman Bits last 5 times longer with less than .005" OD variance.

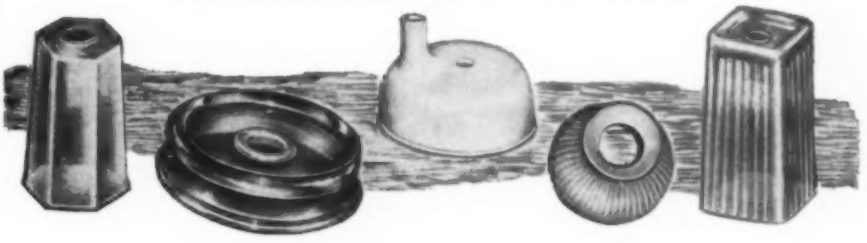
Because Hoffman designs every "Narrow Kerf"* Bit for the specific job . . . users are assured of the best possible performance. Tests are made from customer's material samples in Hoffman's Laboratories with full reports supplied to the customer.

Let Hoffman design a better bit for your coring work. Simply send a material sample for testing at NO OBLIGATION TO YOU.

Watch for new data soon to be released covering the success of Hoffman Bits in coring tungsten carbide, titanium, ferrous magnetite, etc.

*Represents Wall Thickness of Diamond Crown from .015" to .093".

Hoffman Bits Produce These and Similar Items At High Speed.



Send for Literature and Prices . . . Ask about Sample Testing

HOFFMAN BROS. DRILLING COMPANY

102 CEDAR STREET **PUNXSUTAWNEY, PENNA.**

Use postpaid card. Circle No. 238

housing for maximum operator safety. Barrels are constructed of durable neoprene which is resistant to oils, greases and most chemical solutions. They are steel reinforced and have a heavy gauge sheet steel end door with a molded neoprene gasket for positive, leak-proof sealing.

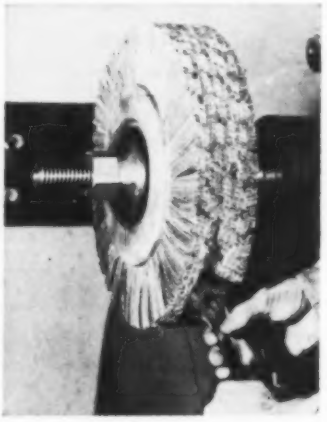
One of the advantages of the machine is that up to eight barrels can be run simultaneously on the largest models. However, regardless of the number of barrels in operation each can be removed or placed on the rollers with minimum effort for either loading or unloading without shutting off the machine.

Techline Division of Wheelabrator Corp., 1169 Avenue V, Vicksburg, Mich.

Use postpaid card. Circle No. 36

Slashed Grind-O-Flex Wheel

To give greater flexibility for cleaning and polishing contoured metal parts, a "slashed" version of the Grind-O-Flex flexible grinding wheel has recently been introduced. The abrasive cloth "leaves" are cut into thin strips and as the wheel rotates these "abrasive fingers" mold to irregular shapes to get into places which were formerly



finished by hand. Wheel sizes are 14" and 16" diameter and are available from 3" to 60" in width. Grits available from 50 to 320 aluminum oxide cloth.

"Slashed" Grind-O-Flex wheels are equally as effective on soft metals as on hard. Ideal for satin finishing aluminum as well as stainless steel.

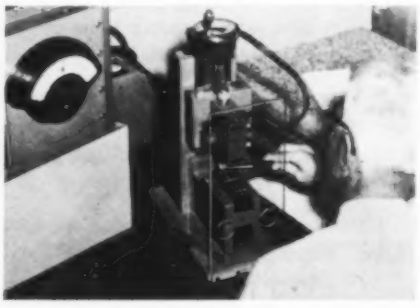
Merit Products, Inc., Los Angeles, Calif.

Use postpaid card. Circle No. 37

Gage Block Comparator

Electronic Comparator, capable of detecting dimensional variations of one-millionth of an inch, was originally developed for measuring Master and Working Gage Blocks in Federal Products' own gage laboratory. Model 130 B-12 can accurately measure gage blocks as large as 4".

Precision ground reference platen is fitted with two sets of three balls



which provide an accurate three point reference surface for comparing gage blocks. Parts position quickly, and better handling techniques, such as using heat insulated tweezers can be employed. The balls are spaced in one set to accommodate square blocks and the other set takes rectangular.

Federal Products Corp., Providence, Rhode Island.

Use postpaid card. Circle No. 38

Tough Grinding Wheel Forms Dressed Easy as A, B, C

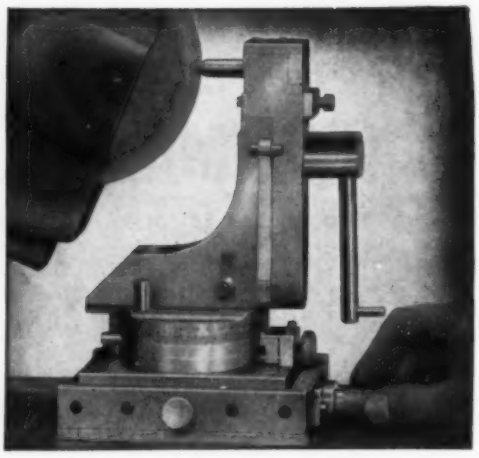
eliminate elaborate set-ups and operations

.0001" ACCURACY

Fluidmotion

WHEEL DRESSERS

dress two angles tangent to a radius in one continuous motion



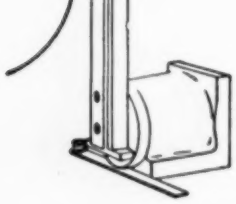
With the unique "Fluidmotion" Dresser, you can dress two angles tangent to a radius — using one handle in one continuous motion. Operation is so fast and simple that beginners can use them.

Adaptable to all type cylindrical and surface grinders.

A. Obtain micrometer reading; add required convex radius or subtract required concave radius.

B. Loosen jib with wrench and "mike" over lower pins to reading obtained above.

C. Tighten jib. Set stops for two angles. Ready for action.



Also available: "FORM MASTER" Dresser, capable of dressing any radii up to 12" convex, up to 15" concave.

See your industrial distributor or write for free literature.

J&S TOOL CO., INC. — CLAMPCUT

J & S TOOL CO., INC. | 880 DORSA AVE. LIVINGSTON, NEW JERSEY

Use postpaid card. Circle No. 239

Production Drill Point Grinder

New drill point grinder will grind conventional, formed or split points on a high-precision, high-production basis. The Morse grinder reportedly ground 450 no. 40 drills per hour in their plant. V-rest drill holder securely holds and positions each drill for grinding, eliminating the need for time-consuming loading or adjusting of bushings, jaws

or collets. Calibrated swivel fixture grinds conventional points with included angle of 118° to 150° and there are also provisions to point all drills from 1/16 to ½" diameter and up to six inches in length. All grinding is done wet using an integral pump. Unit is 2' x 3' x 4' high.

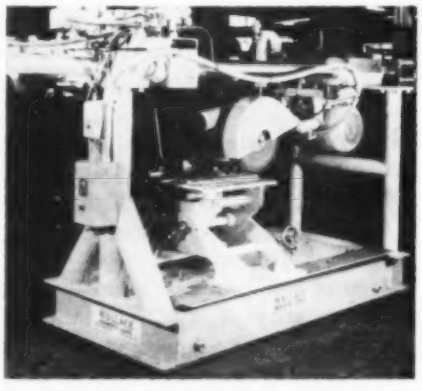
Morse Twist Drill and Machine Co., New Bedford, Massachusetts.

Use postpaid card. Circle No. 39

Traversing "See-Saw" Abrasive Cut-Off Machine

An oscillating type abrasive cut-off machine is now available in three sizes.

The smallest, with a 20" wheel and a 15 hp motor, can cut shapes equal to a



24" x 6" I-beam. The second, with a 26" wheel and a 20 hp motor, cuts

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shapes equivalent to 30" x 8" I-beams. The largest uses a 34" wheel and a 40 hp motor, cuts shapes equalling 36" x 12" I-beams.

The largest unit is used wet. The others are dry.

Standard stroke lengths for the three machines are 24", 30" and 36", respectively. Other than standard stroke lengths can be furnished.

Cut surfaces can be on the order of 50 microinch finish. Standard channels with 60 lb. per foot sections have been cut in 60 seconds.

Traverse feeds are vernier controlled. Traverse movements are controlled by an on-off thumb switch.

Wallace Supplies Mfg. Co., Chicago 14, Illinois.

Use postpaid card. Circle No. 40

Rugged Horizontal Barrel Finishing Machine

"Finishmaster" is a new rugged horizontal barrel finishing machine using ¼" steel plate on the frame and requiring only five square feet of floor space. With lightweight armor plate doors that can be lifted by hand, the Baird machine is only 4' high so all loading and unloading can be carried over the top of the machine. It is equipped with a lifting plate under the drive unit so the entire unit can

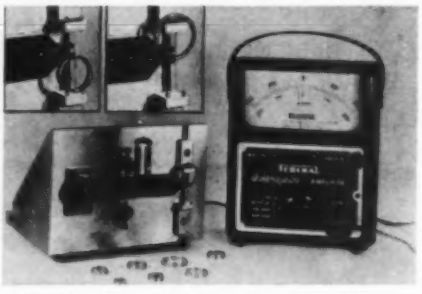
be lifted with a fork lift truck. Included are a variable speed drive for speeds between 8 and 24 RPM, built in brake motor and limit switch to permit jogging.

The Baird Machine Co., Stratford, Conn.

Use postpaid card. Circle No. 41

Electronic I.D.-O.D. Gage for Small Parts

Both inner and outer diameters are accurately measured by a new gage just announced by Federal Products Corp. Measuring both diameters is accomplished without re-mastering and magnification is sufficient to permit



size classification in categories of .0001". While it is designed primarily for ball track diameters of bearing races, it is easily adaptable for measuring other parts.

Federal Products Corp., Providence, Rhode Island.

Use postpaid card. Circle No. 42

New Tangential Angle Dresser

A new grinding wheel dresser, L. Newman's Model No. 10, is designed to fill the need for a heavy-duty, low-cost wheel dresser.

Made of a high tensile strength cast aluminum alloy, it is 6" long, with a ¾" shank. Arbor equipment includes sealed ball bearings.

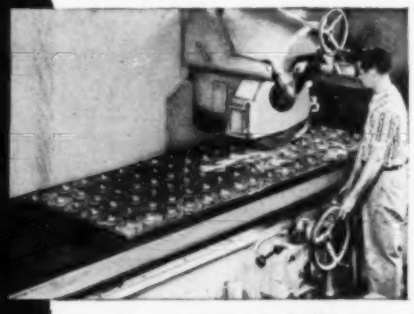
Specially developed cutters and abrasive wheels are interchangeable. The

For Holding

SMALL

MEDIUM or

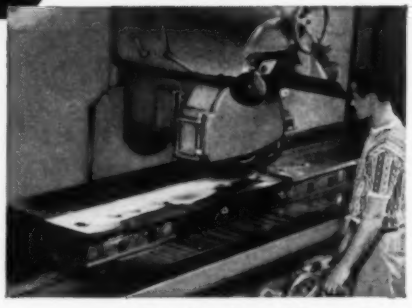
LARGE PARTS



Grinding a load of 102 gears.

Use Sundstrand Magnetic Chucks

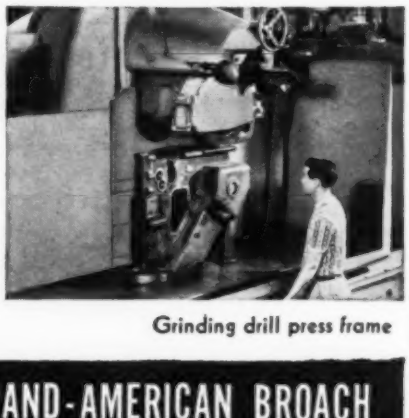
Here's another interesting application of magnetic holding applied to a surface grinder. The deep penetrating power of the Sundstrand magnetic chucks makes it possible to hold a great number of small parts or large castings. In all cases setup is simplified and clamping time is greatly reduced.
Whether you have tool room, production, or special holding problems, look into the possibilities of eliminating expensive clamping and increasing production with Sundstrand Magnetic Chucks.



Grinding four slide castings.

Get All the Facts

Write for complete information on these time saving magnetic chucks. Ask for bulletin A-353.



Grinding drill press frame

SUNDSTRAND

POWER-GRIP

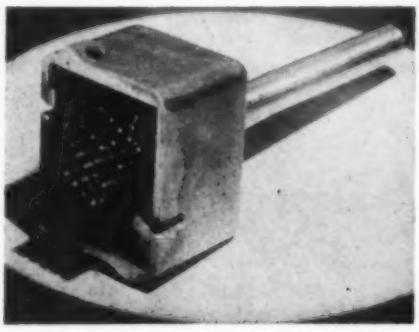
SUNDSTRAND-AMERICAN BROACH

DIVISION OF SUNDSTRAND CORPORATION

MAGNETIC DEPT. ANN ARBOR, MICH.

Use postpaid card. Circle No. 241

built-in tangential angle of the cutters (or wheels) eliminates the need for a breaking device, assures sharp, cool grinding, eliminates burn checks and flying dead grain.



L. Newman, 1001—24th Street, Oakland 7, California.

Use postpaid card. Circle No. 43

Wide Range Comparator Tilts

New Model "B-2" features a cast aluminum base with an angle support that may be folded out to tilt the whole unit 20° upward from the horizontal enabling

straight-on viewing of the dial indicator. Best suited for on the spot checking in laboratory or shop, it can also be mounted for standard production line inspection.

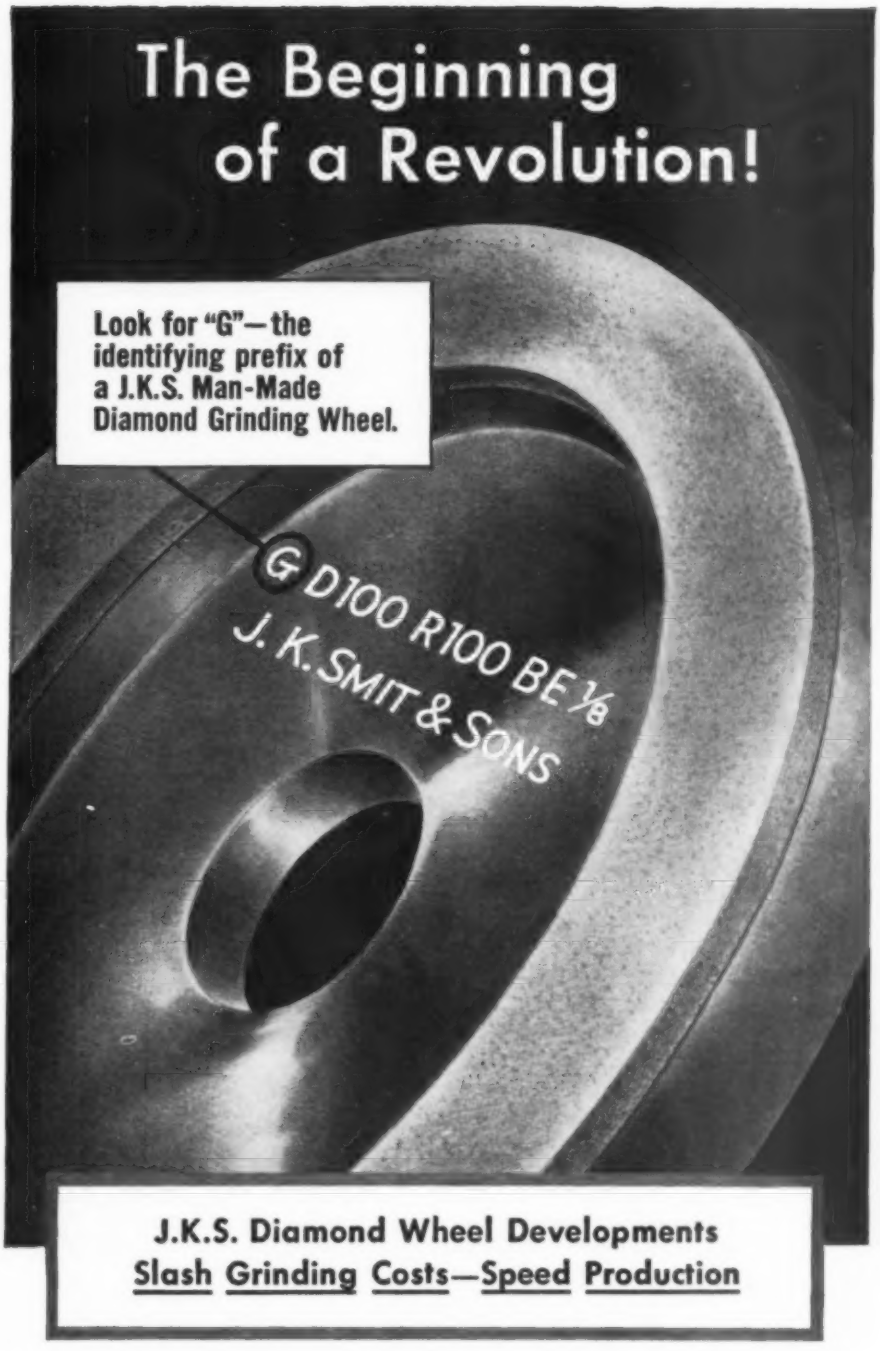
Petz-Emery, Inc., Pleasant Valley, New York.

Use postpaid card. Circle No. 44

Chuck Combines Features of Hand and Power

Utilizing combination of a pinion gear plate, screw and wedge, this new chuck combines all the desirable features of hand and power chucks. Skinner Chuck Co. claims this new chuck has accuracy within .011" TIR, repeatability without adjustment within .0005" TIR, unequalled gripping power and no size limitations.

In operation, the pinion, which can be turned either by hand or by a


The Beginning of a Revolution!
Look for "G"—the identifying prefix of a J.K.S. Man-Made Diamond Grinding Wheel.
G D100 R100 BE 1/8
J. K. SMIT & SONS
J.K.S. Diamond Wheel Developments
Slash Grinding Costs—Speed Production

Now, one of the world's most experienced manufacturers of diamond grinding wheels has brought its technical knowledge to the production of man-made diamond wheels.

The result is a revolutionary advance. Today's new J.K.S. man-made diamond wheels give longer life in many applications . . . speed up production on many difficult grinding jobs. Yet there is no extra cost . . . they are now priced the same as wheels made with natural diamonds.

In these wheels, too, you get a famous J.K.S. plus value: exact uniformity in wheel construction . . . duplicated in wheel after wheel . . . an advantage that results from special J.K.S. techniques and quality control.

NEW DIAMOND WHEEL CATALOG NO. 65

A necessary reference publication for everyone who buys or uses diamond grinding wheels . . . send today for Catalog, "J.K.S. Diamond Wheels, Saws and Hones."

J. K. Smit & Sons, Inc.

Home Office and Plant

MURRAY HILL, NEW JERSEY

DETROIT, MICH.

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power wrench, engages the gear plate causing the screw to move the wedge. The action of the screw on the wedge controls the chuck jaws. The force of the wedge on the jaw holds the work with tremendous force. Chuck is available in sizes from 10" to 60" and above. There is also a choice of jaw types.

Skinner Chuck Co., New Britain, Connecticut.

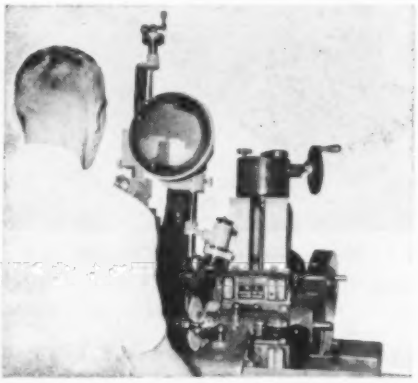
Use postpaid card. Circle No. 45

New Portable Optical Projector

A new portable optical projector which may be attached to a variety of machine tools allows continuous precise magnified checking, direct measurement and comparison of work contours to transparent overlay charts.

Since the projector is portable it is easily converted from one application to another, or it may be permanently mounted on existing grinders or other machine tools.

The most convenient applications have been in circular and flat form



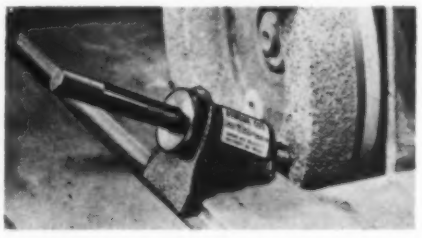
tool grinding, production grinding of precision contours, regrinding of tools and dressing of critical wheel and tool shapes.

Stocker & Yale, Inc., Marblehead, Massachusetts.

Use postpaid card. Circle No. 46

Diamond Wheel Dresser

Versatile little wheel dresser especially suitable for dressing and truing plate mounted and pedestal type grinding wheels, gives substantial wheel life savings and increases life and performance



of cutting tools. The Last Word Dymond Cut wheel dresser is equipped with an approximate ¼ K diamond which is replaceable.

Last Word Sales Co., Detroit, Mich.

Use postpaid card. Circle No. 47

Cylindrical Grinding to .0001" and 3 RMS

Myford MG12 Cylindrical Grinder with a capacity of 3" x 12" between centers and a swing of 5" can obtain finishes of 3 micro inches and repetitive accuracy of .0001". Parallelism and roundness are held to millionths using the live center. Accuracy and finishes are provided by using a hardened and ground feedscrew with forced lubrication and fine feed adjustment to dead stop to .000025". Fixed workhead powered by a DC drive guarantees the

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Development of New Methods Cuts Costs!

The greatest money-saving opportunities in Metal Finishing is yours now . . . in the use of H. W. KRAMER barrel Finishing!

Now, you can finish parts by the hundreds instead of the conventional methods that finish 1 part at the time. It's real easy work . . . it's childs play!

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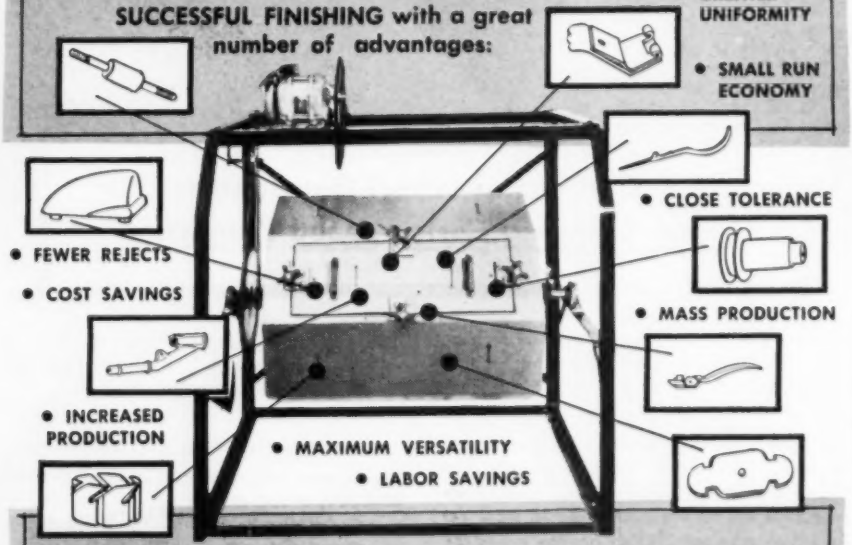
Only Kramer's Tumblers & Buffers give you SUCCESSFUL FINISHING with a great number of advantages:



H. W. KRAMER solves any of your FINISHING PROBLEMS. Guaranteed prompt assistance in solving and determining the proper finishing procedure. Write Dept. 76 for Free Literature.

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Take advantage of H. W. KRAMER'S FREE SAMPLE PROCESSING SERVICE

BUFFS, BUFFING WHEELS & COMPOUNDS for every Industry

SPECIAL COMPOUNDS for SPECIAL APPLICATIONS

H.W. Kramer

120-30 Jamaica Avenue, Richmond Hill 18, N.Y.

Use postpaid card. Circle No. 243

utmost rigidity in holding work on dead or live centers. Unique spindle design has been used both for wheel and workhead spindles which rest in long taper phosphor bronze, handscraped front journals and twin angular contact preloaded bearings in the rear.

Bentley Industrial Corp., New York, N.Y.

Use postpaid card. Circle No. 48

Centrifuge Coolant Clarifier

New Centrifuge designed for grinding, honing, lapping, polishing, and cutting machines as well as many other industrial uses, are manufactured in two models. The Model 510 with 150 gallon per hour capacity and Model

515 with 1000 gallon per hour capacity may be used in multiples for larger volume applications. Simple installation can be made on any machine with pipe fittings or rubber hose.

A. M. Lavin Machine Works, Hatboro, Pa.

Use postpaid card. Circle No. 49

Gage Head Simplifies I.D. Grinding

A new "air-fork" gage head design provides easier and more effective size control gaging on internal grinders for work down to 1¼". The fork shape of the gaging head permits it to remain in straight or tapered work continuously without interfering with the reciprocating action of the wheel. In straight ID grinding it was formerly necessary to reciprocate an air plug in unison with the wheel in order to get size information for automatic control. In taper grinding, use of the air-fork eliminates the need for a mechanical contact caliper which would tend to burnish the work.

Since the air-fork can remain in the piece, its measuring cycle is not limited to a series of brief intervals, as in the

but TORIT Dust Collectors protect your workmen and build good morale

Clean working areas make healthier, happier, *more productive* workmen. Torit Dust Collectors trap dust before it irritates workers. Unitized Torit Dust Collectors are completely portable—cost a fraction of central built-in units and are not limited to particular areas. In addition, Torit Collectors save heat by recirculating clean filtered air.

Free descriptive handbook describes all models and applications. Write today to . . .

TORIT MFG. CO. Department 508, 1133 Rankin St. Saint Paul 16, Minnesota

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case of the conventional plug. This simplifies the air system required and reduces its cost.

Design of the air-fork as well as the Federal Air-Electric Gaging system with which it is used permits it to be made .017" smaller than finish size. This provides much greater than usual approach range, allowing the gage and machine to produce to greater accuracy. Each air-fork is equipped with tungsten carbide guard buttons which prevent it from being damaged in case a badly

undersized piece is fed to the machine.

In a typical installation, the wheel grinds at a fast rate until the Gage sees that the piece is about .0005" oversize, at which point it tells the machine to retract and dress the wheel. Grinding is then resumed, but at a finish rate. The Gage then retracts the wheel automatically as soon as finish size is reached. With this type of control a bank of five machines, possibly more, can be attended by one man.

Federal Products Corp., Providence, Rhode Island.

Use postpaid card. Circle No. 90

Higher Dilution Ratios Increase Coolant Savings

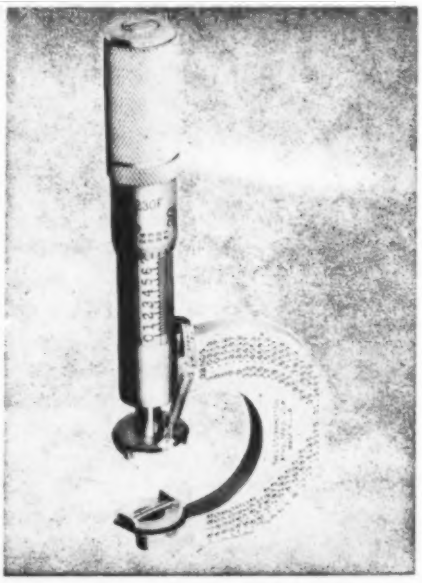
New soluble grinding coolant offers greater economies for grinding operations on carbon and tool steels, cast iron and titanium as well as tool grinding where surface finish is determined by structure of the wheel. Prepared as a concentrate with permissible dilution ratios ranging up to 150/1, A-1000 provides exceptional economy with no loss in lubricity or solution stability. A-1000 leaves no powdery deposit on the critical machine surfaces. The machine itself does the mixing—no special procedure being required. Bacteria static, new Shear-Speed A-1000 helps protect hands and other exposed skin against normal causes of dermatitis. It's non-rancid and develops no objectionable odors.

Shear-Speed Chemical Products, Division of Michigan Tool Co., Detroit, Mich.

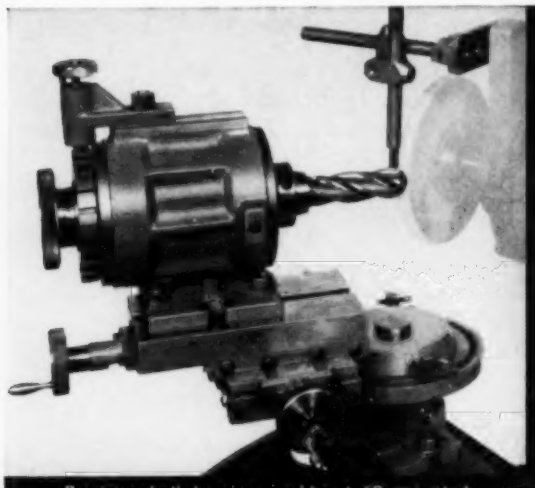
Use postpaid card. Circle No. 51

Thread Measuring Wire Carriers

Carriers for the widely accepted 3-wire method to thread measurement are



useful for checking wear of thread plug gages, for in-process inspection and for receiving inspection. Measuring with these attachments is practically as easy



Precision ball bearing workhead 6B mounted on compound Slide for setting cutter to correct position when grinding end cutting flutes and radii. Other type workheads available.

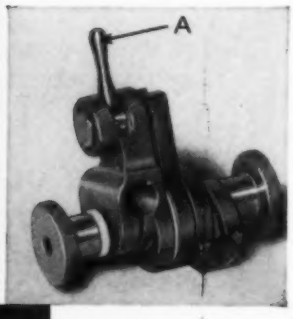
THE UNIVERSAL RADIAL CUTTER GRINDING FIXTURE

Radial Grinding Attachment D combines with Unit 1A for sharpening end mills with square, conical, or ball nose shapes.

UNIT 1A. Universal Cutter Grinding Fixture fits any universal tool or surface grinder.

UNIT 4A. Radial Grinding Fixture for sharpening fluted end mills with square, conical, or ball-nose mills. The index disc provides for multi-flute cutters.

NEW FINE-ADJUSTMENT SLIDING SWIVEL GIVES SMOOTH, PRECISE INDICATOR SETTING.
Smooth, positive positioning of finest dial indicator is readily accomplished by the fine-adjustment Sliding Swivel. Final precise positioning is accurately made by slight movement of convenient lever "A"



RTD

ROCHELEAU TOOL AND DIE CO. INC.
650 NO. MAIN STREET, LEOMINSTER, MASS.

WRITE FOR: SLIDING SWIVEL FOLDER

Use postpaid card. Circle No. 245

as making plain OD measurements, Standard Gage Co., Inc. states. Against hand-held wires there is a considerable savings in time in making measurements. Against other devices the maker states that the free floating action of the wires within uniquely adequate limits gives proper seating for correct readings.

Carriers are of two main kinds, those for micrometers and those for measuring machines having ⅜" diameter anvils. Micrometer carriers are made for Starrett Micrometers and will measure the pitch diameter of American National and Unified 60° threads from No. 0 through ¾" diameter and all standard pitches 10 through 80 threads per inch.

Standard Gage Co., Inc., Poughkeepsie, N.Y.

Use postpaid card. Circle No. 52

Dry Abrasive Cutting Machine

High speed dry abrasive cutting machine cuts with 1/32" thickness cutting wheel; runs cooler, minimizes burn, cuts required little or no hand finishing. The Junior 2, cuts hardened steel at rate of

3 to 6 seconds per square inch without changing Rockwell or PSI readings. Cuts diameters up to 2¼" and solids up to 1½" square. Weighing only 60 pounds it is easily portable in the shop or can be taken into the field.

Crabtree Mfg. Co., Dallas, Texas.

Use postpaid card. Circle No. 53

Versatile Machine Tool for Lab Repairs, Replacements

A compact, versatile machine tool that enables small shops and laboratories to make emergency repairs and even to manufacture their own replacement parts for equipment is now available.

Called the Unimat, the new machine is said to combine in one unit a lathe, drill press, tool and surface grinder, and polisher. Designed with odd jobs

POSITIVE FILTRATION

(TO 1/2 MICRON) FOR AS LITTLE AS

.00015¢ PER GALLON!

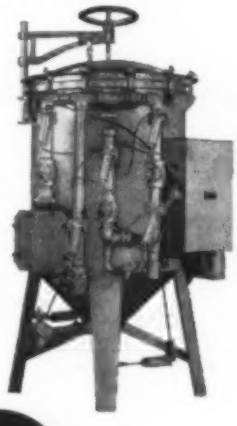
AND IT'S COMPLETELY AUTOMATIC!

Now, from Olson, a new dimension in industrial filtration — the first completely automatic, pressure-type filter! Every cycle — precoat, run, backwash—is automatically controlled. Injection of filter-aid (when used) and sludge carry-out are also automatic.

Maintenance is virtually eliminated in this trouble-free system. No parts to change, no elements to replace, and most important, *no costly downtime for cleaning!*

In large central systems, or with individual machines, Olson Filters guarantee over 96% purification of all types of coolants, cutting oils, quenching oils, cleaning and washing solutions and other industrial solvents at the lowest cost per gallon.

By the way, what are *your* costs per gallon? Why not check and see? Then call Olson.

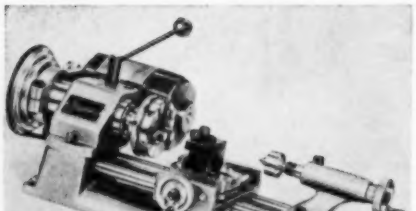


The new Olson Industrial Filter is available in 8 standard models, from 10 gpm to 600 gpm capacities.

Write for free catalog on the new Olson automatic pressure-type filter.

OLSON FILTRATION ENGINEERS
Division of The American Laundry Machinery Company
DEPT G, CINCINNATI 12, OHIO

Use postpaid card. Circle No. 246



around the lab in mind, the machine is about as big as a typewriter.

Attachments available include parts that convert it to a vertical milling machine, a jig saw, bench saw, or gear indexing and dividing machine.

Other accessories include a flexible shaft, collet chucks, live center, independent four-jaw chuck, cross side clamping vise and a steady rest, as well as attachments for wood turning.

Chicago Apparatus Company, Chicago, Illinois.

Use postpaid card. Circle No. 54

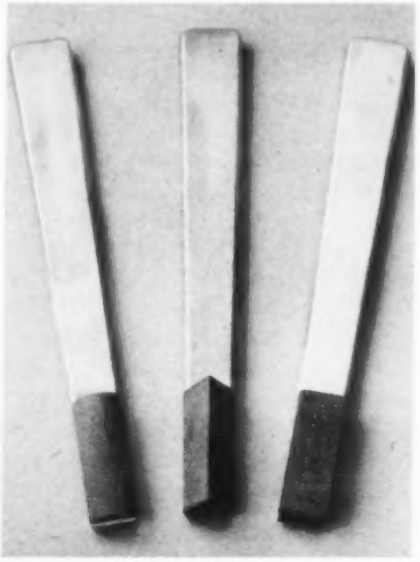
Boron Carbide Hand Lapping Tool

A new line of hand lapping tools made from boron carbide provide a rapid and long-lasting cutting action for sharpening and lapping carbide and hardened steel tools.

In hardness, boron carbide far exceeds tool carbide, and approaches the diamond.

These Tetrabor hand laps are said to be suited to tool room and grinding department applications, since cutting tools can be dressed or sharpened without being removed from machine or holder.

Maximum cutting efficiency is maintained by an occasional roughing of the working surface with loose boron carbide grit.



Tetrabor laps are available in three shapes—flat, half-round and triangular. Price—$9.80.

Titan Tool Supply Co., Inc. Box K, 1419 Hertel Ave., Buffalo 16, N.Y.

Use postpaid card. Circle No. 55

New Polishing, Buffing Wheels

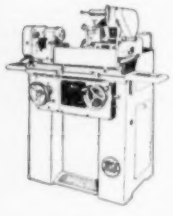
A unique "flapper wheel" and two new designs in abrasive flex wheels have recently been introduced to the metal-finishing trade.

The "flapper" is claimed to outperform any other buffing wheel by as much as 200%. Flaps are positioned

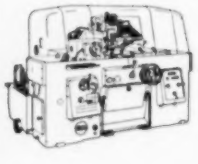
MSO Since 1865 **SOLVES Grinding Problems**

This is the 94th consecutive year of MSO leadership in the development of improved grinding methods.
MSO offers unequalled precision in the most advanced grinding machines available anywhere.
Today, when your grinding problems are more complex than ever before, MSO, as always is one step ahead with the solution.

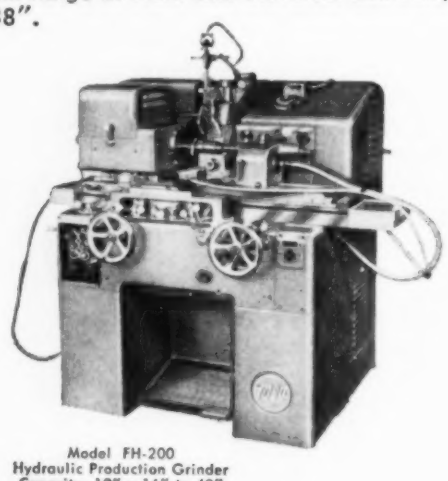
The MSO line comprises a full range of Plain and Universal Grinders, Cap. 7" x 12" to 22" x 138".



MODEL FMES UNIVERSAL GRINDER



MODEL GA-2 HYDRAULIC THREAD GRINDER



Model FH-200
Hydraulic Production Grinder
Capacity: 10" x 16" to 40"

FEATURES:
- Rapid traverse to wheelhead
- Equipped for traverse and plunge-cut grinding
- Selection of 4 automatic cycles with fine finishing feed, adjustable spark-out and automatic cut-out
- Manual and automatic table and wheelhead movement
- Fine feed to .0001" by quick lever trip
- "Precimatic" electric grinding gauge sizes to .0001"

austin industrial corporation
76-G Mamaroneck Avenue White Plains, New York

Use postpaid card. Circle No. 247

at right angles to the wheel axis, and each is a self-contained buffing unit.

Each one wipes up and cleans after the other, leaving a clean, smooth-buffed surface. The design keeps fraying to a minimum, applies compound evenly.

These wheels are made of cloth, sisal or a combination of both.

The Uniflex and Amflex wheels are made of abrasive-impregnated cloth, can be installed ahead of other buffs on a single lathe, producing an "automated" finishing set-up.

There are 16 sizes of Uniflex and Amflex wheels with 3", 5", 7", and 9" centers. Grit sizes are 80, 120, 240 and 320.

American Buff Co., Chicago 16, Ill.

Use postpaid card. Circle No. 56

Centerless Regulating Wheels

Rubber bonded regulating wheels for centerless grinding operations have recently been added to the Simonds-Worden-White product line.

These Dayton Safety wheels are designed for use in all types of center-

less operations. Types 1, 5 and 7 wheels, in rubber bonded aluminum oxide are available in sizes from 8" to 14" diameters.

Simonds-Worden-White Co., Dayton 7, Ohio.

Use postpaid card. Circle No. 57

Improved, Low-Maintenance Dial Indicator

New dial indicator movement mechanism has greatly improved resistance to wear and shock, providing much longer operational life and the reduction of maintenance costs by as much as 80%. This indicator, known as the Miracle Movement Indicator, is the result of recent improvements in a special process developed for producing key parts, achieving sufficient toughness to provide protection against shock without the need for any additional cushioning devices, as were necessary in the past.

This Movement is interchangeable with the Federal Indicator Movement it supercedes and is available with

Ever see a ROUND WHEEL fit into a SQUARE CORNER ?

GRIND-O-FLEX DOES IT

Unretouched photo

Here's a 3-inch diameter Grind-O-Flex wheel smoothing and blending draw marks and welds on a tubular frame. Note how it shapes itself to the contour.

and for ROUGH JOBS...

Grind-O-Flex comes in big diameters too—in fine or coarse grits—to blend welds, smooth casting flash, polish rough surfaces. Wheels form themselves to fit the job. No danger of "digging" into stock. There is a grit grade to fit your job, polish or grind.

Beautiful-finish-wise, cost-wise and time-saving-wise, nothing can touch GRIND-O-FLEX.

Our Engineering Staff can recommend the wheel for your job, and a supply source near you. Write us.

merit PRODUCTS, INC.

3691 Lewanee Ave., Los Angeles 16, California

Use postpaid card. Circle No. 248

either Full-Jeweled or Plain Bearings. It is now furnished on all Regular, Perpendicular, Waterproof and Electricator Models, as well as most Long Range Federal Indicators.

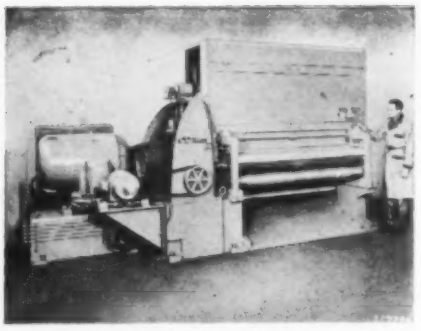
Federal Products Corp., Providence, Rhode Island.

Use postpaid card. Circle No. 58

Automated Sheet Polishing Mills

Sheet polishing mills that provide a continuous automated method for abrasive belt finishing operations on metal sheets and plate from 3' in length and up, as well as on coils, at feeds from 20 to 60 fpm are said to hold tolerances of plus or minus 0.001" when stock removal is within 0.010".

Typical Acme standardized units are made to handle stock widths of 30", 40", 54" or 74". The 74" model illustrated has a 150 hp main drive



motor and a 75" belt width. It occupies a floor space about 5½' x 16½', and is about 9' high. When these mills are lined up in tandem, the center-to-center distance between the units is about 6' 3".

Acme Manufacturing Company, Detroit 20, Michigan.

Use postpaid card. Circle No. 59

New Grinding Wheel Treatment

A new treatment for grinding wheels retards loading and functions as a dry coolant. Once the wheel has been impregnated by dipping in "Dri-Kool", its pore surfaces throughout become coated with a parting medium. This solid lubricant prohibits the chip metal from gripping the abrasive and bond surfaces with the usual affinity.

Users are reporting burn-free, burr-free dry grinding of high speed steels for the first time. Dressings are less frequent; wheels last longer although grinding is faster. Micro-finishes are improved on such abrasive-resistant materials as M-3 H.S.S. where burn was formerly encountered. A single treatment is sufficient for the life of the wheel.

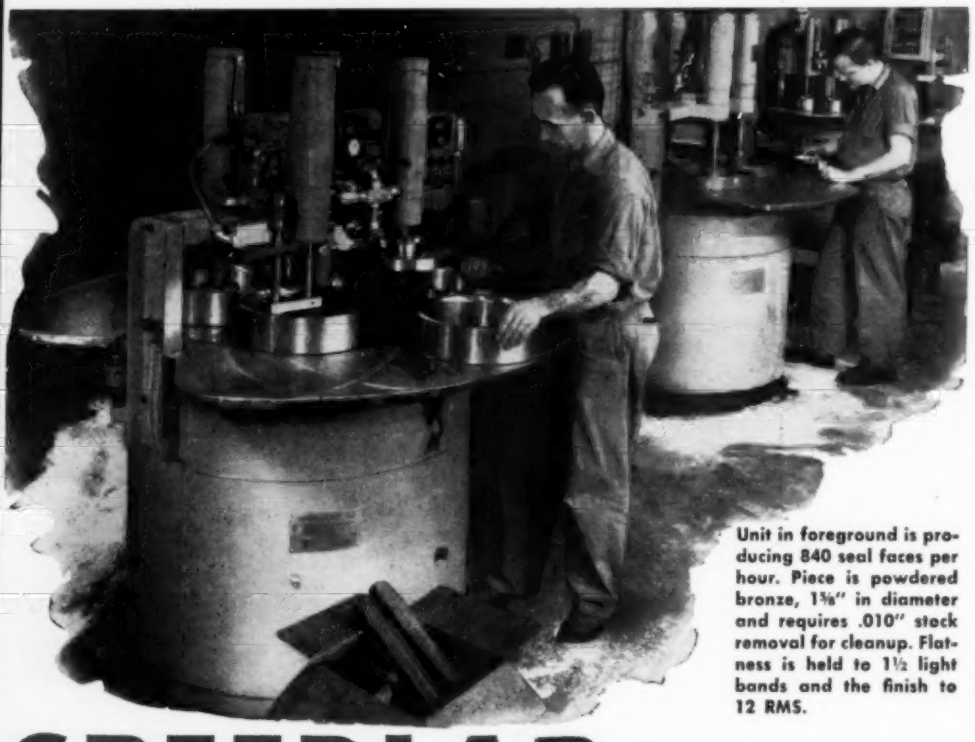
King Graphite Products, Trenton, Michigan.

Use postpaid card. Circle No. 60

High-Speed Orbital Air Sander

Operating at 8,500 rpm, a new orbital air sander is said to provide faster and more efficient stock removal, with consequent savings in time and costs for the user.

The sander operates on normal air line pressure, combining balanced design, light weight and compactness to



Unit in foreground is producing 840 seal faces per hour. Piece is powdered bronze, 1⅜" in diameter and requires .010" stock removal for cleanup. Flatness is held to 1½ light bands and the finish to 12 RMS.

SPEEDLAP *with . . . . .*

ONE OPERATOR PRODUCING

840 SEAL FACES PER HOUR

If your production calls for rapid stock removal with high accuracy in size, flatness, parallelism and finish, be sure to check on Speedlap's performance.

These units grind and lap at the same time with micro-inch accuracy. Give you finishes of 1 RMS; flatness and parallelism to 2 millionths of an inch—with tungsten carbides, ceramics, tough alloys or plastics. Best of all they give you LAPPING ACCURACY AT GRINDING PRICES.

Ask for cost and production estimates based on samples of your work. No obligation. Job lapping service also available.

5 *Exclusive* FEATURES

enable a Speedlap to finish jobs better and faster:

- Water cooled lap base dissipates operational heat to avoid distortion.
- Non-chargeable alloy lap plate assures rapid stock removal.
- Full wear control maintains constant lap flatness.
- Adjustable parts handling stage loads and unloads parts quickly.
- Full pressure air system maintains maximum lapping pressure and automatically raises pressure plates at end of lapping cycle.

ABRADING SYSTEMS COMPANY / 8020 North Monticello Avenue Skokie, Illinois

Use postpaid card. Circle No. 249

make it easy to use over a wide variety of finishing operations. The tool sands right up to edges, making extra finishing operations unnecessary, according to the manufacturer.

Standard 3-2/3" x 9" sheets of coated abrasives are used.

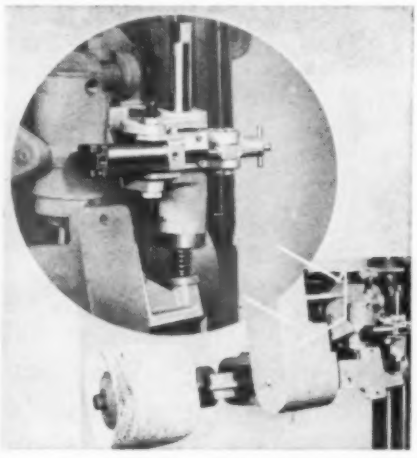
Aro Equipment Corporation, Bryan, Ohio.

Use postpaid card. Circle No. 61

Wear Compensator for Buffing Heads

A new feature accessory which accurately compensates for work wheel wear is now obtainable with all buffing and polishing heads.

Polishing and buffing wheels require constant adjustment because of wear. Previously this could only be



done by manually adjusting each individual head, a time-consuming and awkward process.

The new accessory makes use of an electrical jog button which lowers the wheel a predetermined distance per jog. When the operator sees that the head is not operating at full efficiency, he merely pushes the button.

Murray-Way Corporation, Birmingham, Michigan.

Use postpaid card. Circle No. 62

Portable Abrasives Line Filled

Completing their specialty line, Abrasive Company of America can now supply an abrasive for every type of portable right angle grinding. Both

Built to machine tool standards . . .
TO GIVE TOOL ROOM PRECISION . . .
IN PRODUCTION QUANTITIES!

NEW
ENGELBERG
SERIES 96
ABRASIVE BELT
MACHINES

Write today for free catalog sheet containing complete information and specifications on the Engelberg Series 96 abrasive belt machines.

AVAILABLE WITH FROM ONE TO SIX OR MORE GRINDING HEADS

CAPACITIES:

6" x 96" Belt:
5½" max. width and
6½" max. thickness

9" x 96" Belt:
8½" max. width and
6½" max. thickness

12" x 96" Belt:
11½" max. width and
6½" max. thickness

OPTIONAL FEATURES:

Electro-Magnetic chucks
Powered elevation of grinding heads
Built-in coolant filtration system

From the leaders in the industry . . .

The new Series 96 Heavy Duty abrasive belt machines are built to deliver toolroom precision in continuous production runs.

High speed multiple grinding and finishing operations are performed in the same time required for a single operation. Rapid, exceptionally heavy stock removal permits unmachined surfaces to be ground to fine finishes and exacting tolerances in one continuous pass.

Heavier construction and solid, one-piece work table enable Series 96 machines to maintain tolerance standards of ± .0005 on flat finishing, with stock removal up to 1/32" per head on ferrous material.

Conveyorized feed is adjustable, ranging from 0' to 67' per minute. Both conveyor and abrasive belts feature pneumatic tensioning.

Rapid-traverse grinding heads are equipped with #50-taper hardened precision ground spindles, with super-precision taper roller bearings.

Representing the peak of development in abrasive belt machines, Series 96 take their place beside the finest of machine tools for speed, precision, reliability and cost reduction.

SUNDSTRAND-ENGELBERG
Precision **Abrasive Belt Grinders**

SUNDSTRAND
SUNDSTRAND MACHINE TOOL
Division of SUNDSTRAND CORPORATION
BELVIDERE, ILLINOIS

Use postpaid card. Circle No. 250

resin bonded depressed center and cup wheels have been added to their line of Magnecoated discs.

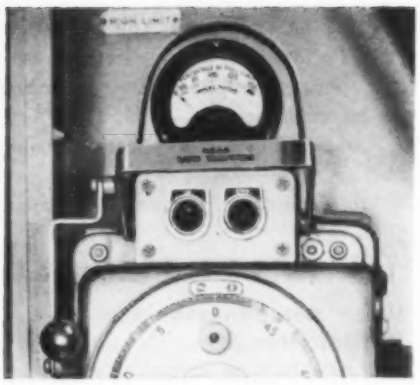
Abrasive Company of America, Fort Lee, New Jersey.

Use postpaid card. Circle No. 63

Motor Load Indicator

A motor load indicator is now available as optional equipment on the Blanchard No. 11 and No. 18 vertical surface grinders. The motor load indicator is designed to replace the ammeter in the wheel motor circuit, to indicate very slight changes in pressure between grinding wheel and work.

Applied to machines which are used for extremely accurate work, or on



which the load is very light, the attachment greatly facilitates operation.

The Blanchard Machine Company, Cambridge 39, Massachusetts.

Use postpaid card. Circle No. 64

New Ultrasonic Impact Grinder

A new ultrasonic grinder expected to be useful in the preparation of ceramic base printed circuits and in other facets of the ceramics industry was introduced at the recent National Metals Exposition.

The new 2,500 watt grinder, similar to smaller models in the Raytheon

line, can cut areas up to 3½" in diameter.

Cutting, slicing, drilling, grinding and trepanning can be accomplished to tolerances of plus or minus .0003". The grinder makes regular or irregular cuts in semiconductors, ceramics, ferrites, carbides and other hard or brittle materials.

Raytheon Company, Waltham 54, Massachusetts.

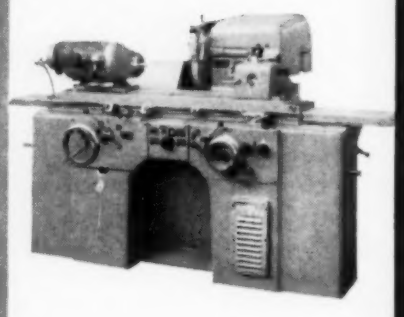
Use postpaid card. Circle No. 65

Grinds 1350 Transmission Gears Per Hour

New machine has been designed and built to grind oil grooves into both thrust faces of hardened transmission gears. Production rate is 800 to 1350

olivetti

high-precision grinding machines with hydraulic automatic infeed for traverse grinding and plunge grinding

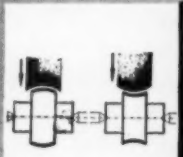


UNIVERSAL. *Swivelling wheelhead, swing-down internal grinding attachment, infinitely variable speed headstock.*

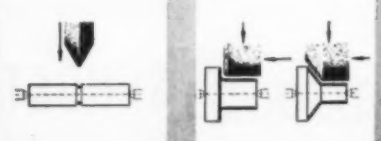
PRODUCTION. *Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.*

Model R4-500 U shown at left. Universal type, 10" swing, 24" center distance.

- *Infinitely variable hydraulically controlled table speeds*
- *Table reversals within ± .0002" as short as 1/16"*
- *Table dwell 0 to 20 seconds*
- *Automatic precision infeed to .000050", right, left or both ends of traverse*
- *Thumb jog for taking .0001" cuts on diameter*
- *Separate automatic plunge feed 0 to .002"/second to positive stop*



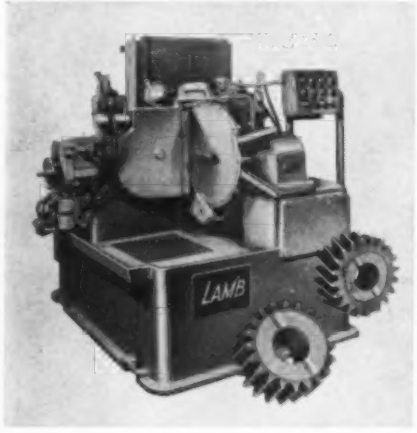
write Olivetti Corporation of America, 42-33 Northern Boulevard, Long Island City 1, New York Or phone RAvenswood 1-7575.



Use postpaid card. Circle No. 251

parts per hour depending on gear size. The machine operates continuously and is completely automatic including wheel dressing and compensation for wheel wear.

Parts are chute fed to a rotating spur type feed wheel that is chain driven. The chain rides on periphery of the feed



wheel and acts as a clamp, holding the parts in the spur pockets as they pass between the opposed grinding wheels. Only feed wheel need be changed to accommodate a different gear size. Micro adjustments of the grinding wheel slides can be set for new part width groove depth dimension. Wheel dressers can be adjusted to any desired radius.

F. Jos. Lamb Co., Detroit, Mich.

Use postpaid card. Circle No. 66

Precision Balancing in Less than 30 Minutes

New balancer offers fast, accurate balancing of grinding wheels without removal of the wheel from the grinder making possible savings up to 80% in grinding operations. Balancers for internal, external, centerless and center grinding machines will be included in the line. The balancer has been designed to achieve precision balancing and return the machine to production in less than 30 minutes.

Once the hub and wheel are in position, accurate balancing of the wheel is accomplished in minutes by using a set of three adjustable weights inserted in the hub. Extensive vibration tests showed repeated accuracy within .000040" displacement (concentricity).

Aero Supply Mfg. Co. Inc., Corry, Pa.

Use postpaid card. Circle No. 67

Optical Comparator Calibration Kit

Handy calibration kit for calibration of any make of optical comparator consists of a 2" x 2" Leitz master stage micrometer and a 14" Gage Deep-Etch Comparator Scale, safely packaged within a mahogany case. The Stage micrometer carries 16 graduations in .100" and two reference marks of .625" distance, all in two directions. Scale affords direct readings in the screen in 10x, 20x and 62½x magnifications. Price $50.00.

Opto-Metric Tools, Inc., New York, N.Y.

Use postpaid card. Circle No. 68

LAWN•BOY reports cost of finishing parts cut appreciably with *Hammond* Abrasive Belt Grinders

LAWN•BOY LAMAR, MISSOURI
DIVISION OF OUTBOARD MARINE CORPORATION
OVERLAND 2-4565

July 22, 1959

Hammond Machinery Builders, Inc.
1600 Douglas Avenue
Kalamazoo, Michigan

Gentlemen:

Some time ago in an effort to alleviate several hand filing operations on contoured parts we purchased a Hammond UBG-25 abrasive belt grinder.

This grinder has proved to be a valuable asset on all adaptable operations and has appreciably cut the finishing price of the parts. The maintenance required to keep our Hammond Grinder in first-class operating condition is almost nil.

We are highly pleased with the results received from this grinder; and as our abrasive finishing operations are increased, we will certainly add to the Hammond equipment we now have.

Yours very truly,
Fred Boham
Tool Designer

Fred Boham:eft

This letter from Lawn-Boy is typical . . . users report that Hammond Abrasive Belt Grinders reduce many costly hand filing, grinding, polishing, deburring and chamfering operations.

MODEL UBG-25
with Built-In DusKolector

OVER 16,000 *Hammond* ABRASIVE BELT GRINDERS NOW IN USE!

Hammond OF KALAMAZOO "Good Machinery Since '82"

write FOR ILLUSTRATED LITERATURE

Hammond Machinery Builders INC.
1651 DOUGLAS AVE. • KALAMAZOO, MICHIGAN

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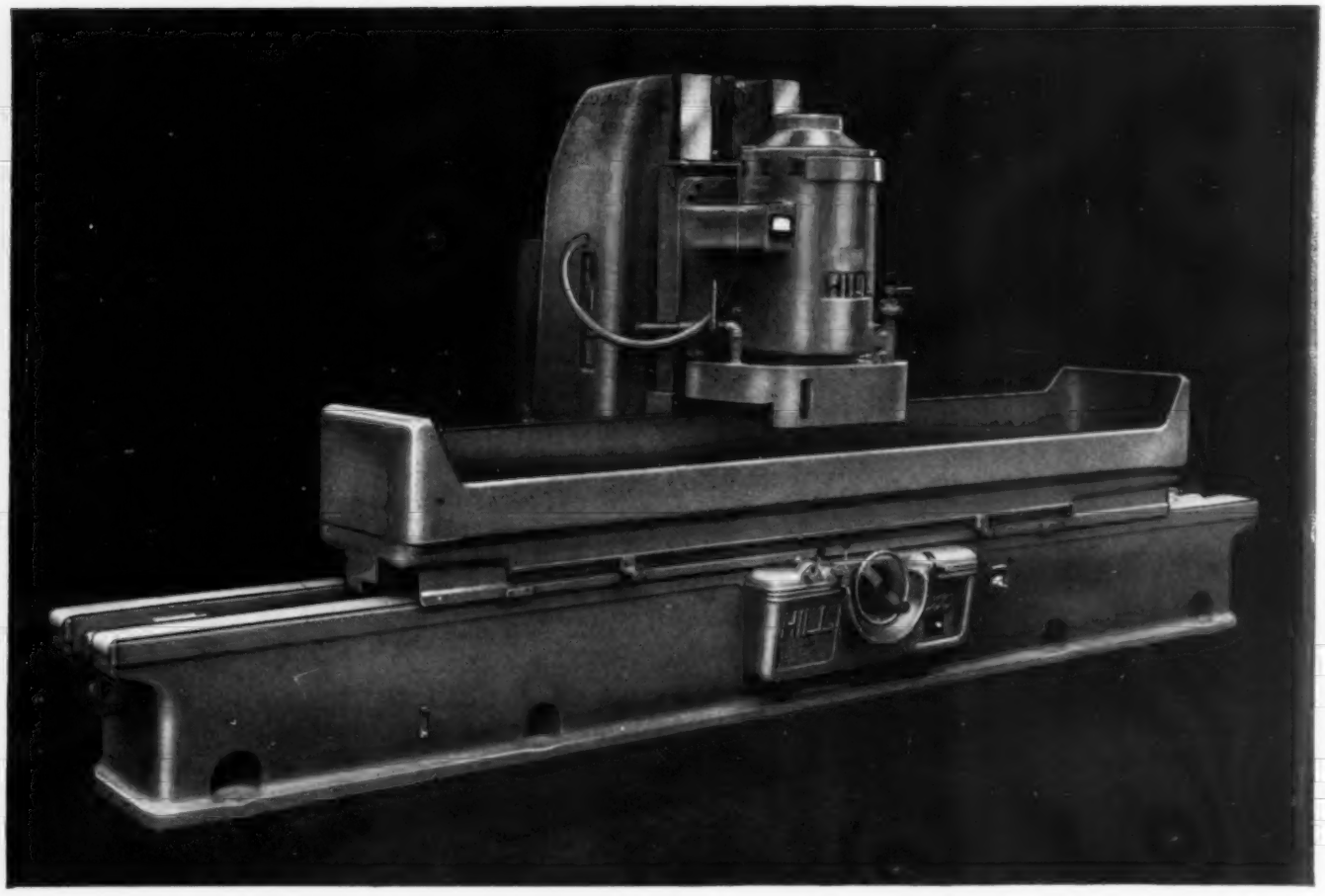
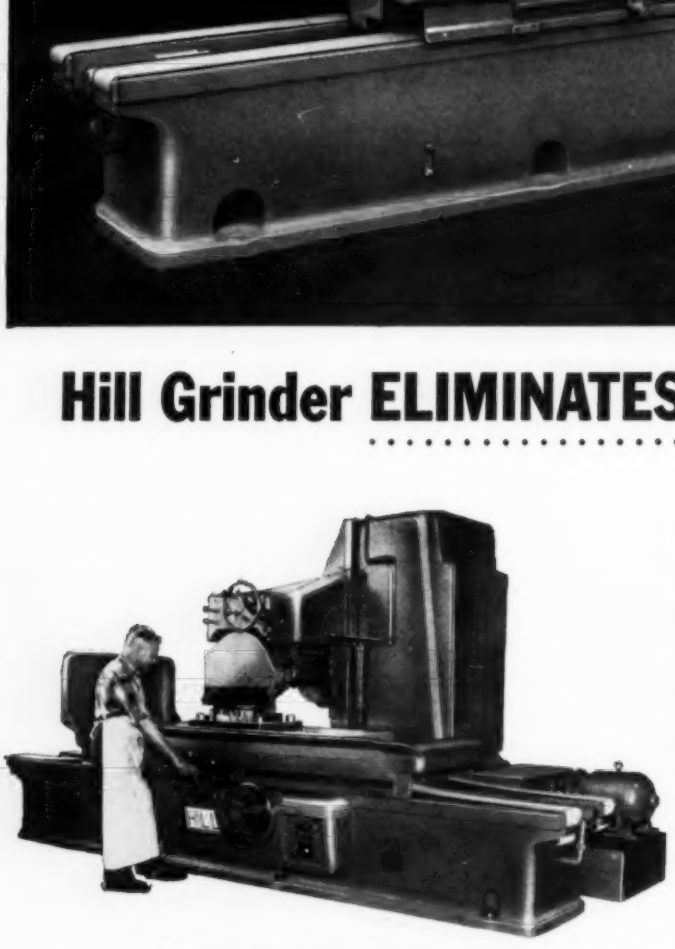


Hill Grinder ELIMINATES MILLING OPERATION



For grinding to extremely close tolerances on flats, angles, irregular and special shaped surfaces the HILL Horizontal Spindle grinder is recommended.

Expensive, time consuming milling operations can be eliminated in finishing die blocks, bolster plates etc. with the new HILL Vertical Spindle Hydraulic Surface Grinder. Equipped with either 75 or 100 HP main spindle motor, the segmented grinding wheel provides fast stock removal and produces an accurate finish in approximately half the time required for a combined milling and grinding operation.

The HILL fully hydraulic reciprocating table is adaptable to a wide variety of stock sizes having flat surfaces. Table widths are 18", 24" and 30" with table lengths from 5 to 20 feet.

HILL ACME TOOLS TO INDUSTRY

The HILL ACME Company

1201 WEST 65th STREET, CLEVELAND 2, OHIO

Also manufacturers of: HILL GRINDING AND POLISHING MACHINES • "ACME" FORGING MACHINES • ROTARY SCRAP SHEARS • ALLIGATOR SHEARS • "CLEVELAND" KNIVES AND SHEAR BLADES • MATERIAL HANDLING EQUIPMENT • BAR-BILLET SHEARS

Use postpaid card. Circle No. 253

American Society for Abrasives

New Jersey Chapter

"Loss Prevention and Safety in Grinding" was the topic for discussion at the September meeting of the New Jersey chapter, held September 16 at the Blue Shutter Inn, Union, N.J.

Mr. McKinley of the Liberty Mutual Insurance Company was the speaker, before thirty-six members and fifteen guests.

Officers of the club are:

President .....**John A. Cornell**
Vice President .....**William Wilkins**
Secretary .....**William J. Yurecko**
Treasurer .....**William Deike**

Chicago Chapter

E. S. Avery, vice president, Waltham Grinding Wheel Company, was the featured speaker at the October meeting. His topic was: "An Introduction to the Grinding Wheel and the Fundamentals of Grinding."

Along with the description of the various types of grinding wheels, the speaker stressed the savings to be derived from using the best size and shape of wheel for the application. He also emphasized the desirability of using standard sizes and shapes of wheels, particularly for securing replacements in emergencies.

About 40 members and guests attended the dinner meeting, which was held at Neilsen's Restaurant, 7330 North Ave.

A discussion period followed the talk.

Note to Cleveland Area Readers

A Cleveland chapter of ASA is now under way. The organization meeting is tentatively set for the Statler, on Friday, November 20.

If you are interested, get in touch with **Leland K. Pruitt, Ford Motor Co., American Road, Dearborn, Michigan,** representative of the National Board of Directors, who is making the arrangements for the meeting.

Mechanical Billet Grinding

Following is a summary of the talk by **Harlow G. Jones,** director of product engineering, **Mid-West Abrasive,** at the **Pittsburgh Chapter** in September.

Attempts to grind steel by mechanical means date back to the 1930's, but it has only been within the last ten years that these have reached any degree of success. Major problems have been the strength of the machine, vibration and the development of a suitable grinding wheel.

Around 1954 an adequate machine was built, which increased the metal removal rate, but rate of wheel wear increased at the same time, so that the cost of steel ground was unaffected.

During the past few years a number of different machines have been built, and new wheels have been developed. Of these, the most radical is probably a heavy, multiple-head slab grinder using fourteen grinding heads with hydraulically controlled pressure on knee-action type wheel mounts. Slabs are moved laterally and crosswise, and the heads staggered in such a manner that a good section of a large slab can be covered in one pass. Mounting provides angular contact between wheel and work, increasing the contact area and minimizing the effect of vibration.

Tests of mechanical grinders have indicated the following advantages:

1. Better surface on ground work.
2. Three to four times increase in the production rate of steel ground.
3. Lower total grinding cost.
4. More attractive, cleaner grinding operations, with greater safety for the operator.
5. A smaller working force.

Long Island Chapter

"Abrasive Cutting in Today's Industry" was the subject discussed by **Curtis D. Cummings** at the Long Island Chapter's October meeting. Mr. Cummings is sales manager for Allison-Campbell Division of American Chain & Cable Co., Inc.

The talk was supplemented by a sound film on the subject, and followed by a question-and-answer period.

At the November meeting, scheduled for November 11 at the Wheatley Hills Tavern, 170 Post Avenue, Westbury, New York, the subject will be "Grinding vs. Machining," with the speaker coming from Mattison Machine Works.

Pittsburgh Chapter Officers

Following are the officers of the Pittsburgh Chapter for 1959-60:

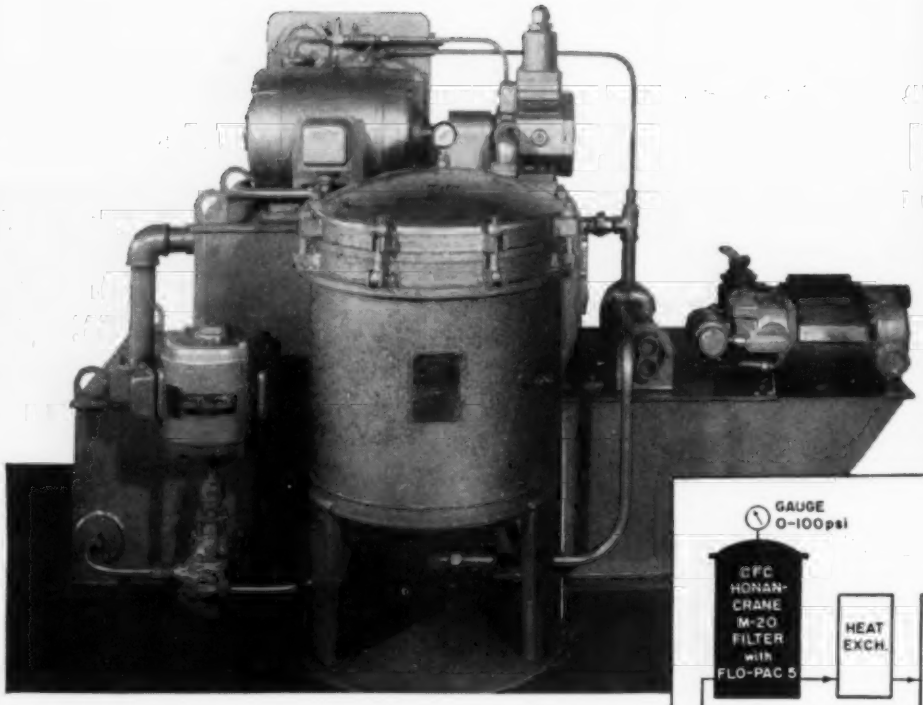
President .....**Clifford G. Beattie**
(Allegheny Ludlum Steel Corp.)
Vice President ....**Russell G. Ecker**
(Universal Cyclops Steel Corp.)
Secretary .....**Frank F. Cramer**
(Norton Co.)
Treasurer .....**Keith Bishop**
(Cortland Grinding Wheels Corp.)
Recording Sec'y .....**Robert Joyce**
(Joyce Abrasive Co.)

Board of Directors . . .
Joseph De Blander ..Universal Cyclops
E. Daniels .....Universal Cyclops
J. J. Patton .....Crucible Steel
L. H. Such .....Allegheny Ludlum

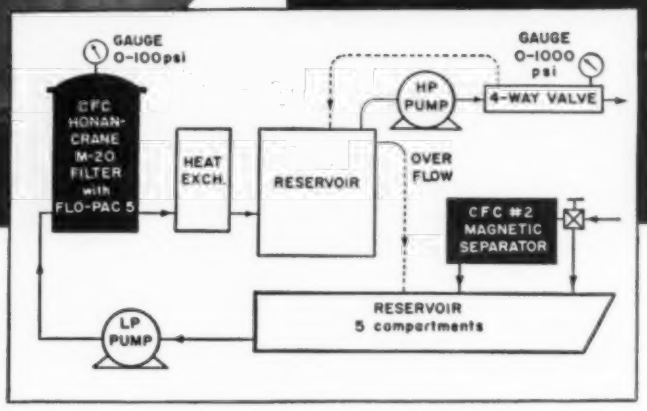
Note to all chapter secretaries or publicity chairmen: We are glad to publish reports of meetings, resumés of speeches and announcements of future meetings, so long as the material reaches us by the 15th of the month.

Material received after the 15th will be held over for a month.

—**The Editors**



This installation, designed and built for a leading electrical manufacturer by Hydro Air Engineering, Inc., St. Louis, Missouri, supplies mineral oil coolant, 90 SUS, at 600 PSI, to target drill. CFC Magnetic Separator removes ferrous contaminants. Oil then passes through compartmented reservoir to provide sedimentation of remaining particles. CFC Honan-Crane Filter then acts as polishing filter to take out contaminants not already removed.



"ON-TARGET" FOR REDUCED COSTS

Hydro Air Engineering, Inc. unit cuts downtime with CFC Honan-Crane Filters and Magnetic Separators

This Hydro Air Engineering, Inc. Unit assures reduced costs on target drill operation by keeping coolants micro-clean with CFC Magnetic Separator and CFC Honan-Crane Filter. Drill has extremely heavy chip load. By maintaining continuous supply of *clean* oil, CFC equipment protects the high pressure pump and valves, and prevents clogging of the drill ports. This means lower costs through reduced downtime, less tool breakage, and fewer rejects.

The low-cost CFC Magnetic Separator, with permanent Alnico magnets, removes ferrous chips automatically and continuously. It is compact, light-weight, easy to install. Unit includes totally enclosed gearhead motor. No separate pump is required.

The CFC Honan-Crane Filter employs the new Flo Pac 5 Cartridge — designed to remove 98% of all particles larger than 5 micron. Tough, resin-impregnated paper provides more than 6300 square inches of filtering surface, per cartridge.

For technical literature, or engineering assistance, write to Department GF.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST

Fulflo FILTERS
with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.

CFC FILTERS
Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.

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News from the Industry

Norton Marks Half-Century in Germany

Norton Company's German plant, Deutsche Norton Gesellschaft, m.b.h., celebrated its 50th anniversary September 28. The first Norton plant built outside of the United States, it is now one of 21 Norton plants operating in 11 countries.

Deutsche Norton Gesellschaft was founded in 1909 at Wesseling, near Cologne, for the purpose of making grinding wheels and refractory products. The following year, the plant was completed and production began.

Foreign Branch Changes Name

The corporate name of Norton Behr-Manning Overseas Inc. has been changed to **Norton International, Inc.** according to an announcement by **A. Donald Kelso,** president.

The corporation itself is not changed in any way. It will continue to operate the firm's 16 plants in 10 countries and to handle export sales of Norton and Behr-Manning products.

DoALL Shows New Lines at National Metal Exposition

Stainless steel gage blocks, a completely new line of electronic inspection instruments and a new small precision surface grinder headed the list of new developments shown at the recent National Metal Exposition by The DoALL Company.

The gage blocks incorporate the desirable properties of stainless to provide longer life of dependable gaging accuracy. These blocks have the same coefficient of expansion as steel gage blocks and may be used interchangeably with them.

In electronic inspection are two new lines, the Trans-Chek and the Micro-Chek. The first is a group of interchangeable transistorized components for fast accurate gaging under shop conditions. The Micro-Chek comparator line is calibrated in millionths of an inch.

Both manual and hydraulic models of a new small surface grinder, the DH-612, were on display. These utilize the same heavy-duty, one hp motors as in larger grinders.

Timken Announces Management Changes

At a recent meeting of the Board of Directors of The Timken Roller Bearing Company, Canton, Ohio, **D. A. Bessmer** was elected president, succeeding **Wm. E. Umstattd,** who had held the position since 1934.

H. E. Markley succeeds Bessmer as executive vice president.

Mr. Umstattd will continue to serve as a director and chairman of the executive committee.

Michigan Abrasive Names Villwock Research Engineer

Richard P. Villwock has been appointed as abrasive engineer of Michigan Abrasive Company, Detroit, Michigan. He was formerly with Mid-West Abrasive Co.

W. E. Umstattd

R. P. Villwock

D. A. Bessmer

H. E. Markley

3M Announces Foreign Appointments

Minnesota Mining & Manufacturing Co. has appointed **Robert D. Scarlett** to the newly-created post of director of new foreign development.

Audun Fredriksen has been chosen to succeed Scarlett as managing director of 3M's German manufacturing subsidiary. He was previously general manager of the Dusseldorf division.

The appointment of **Neil S. George** as manager of international advertising and marketing services is also announced.

Edwin F. Goad has been promoted to Marketing Supervisor for coated abrasives and new products in the Coated Abrasives and Related Products Division of the Minnesota Mining & Manufacturing Co., St. Paul, Minn.

New COOLTEX keeps machines cleaner

Your machines don't *have* to feel like a greased pig that's run through a sand pit! If you switch to new Cooltex, they'll practically pass a white-glove inspection. Ask your local Texaco Lubrication Engineer for the details. Texaco Inc., 135 East 42nd Street, New York 17, N.Y.

TEXACO

Throughout the United States

Canada • Latin America • West Africa

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Blaw-Knox Changes

Blaw-Knox Co., Pittsburgh, has appointed two executive personnel as follows: **George E. Kopetz**, Vice-President of Production, has been named Vice-President and General Manager of the newly formed Fabricating, Engineering and Construction Group, and **Arthur E. Murton**, formerly Roll Sales Vice-President, is now Vice-President and General Manager of the new Foundry & Mill Machinery Group.

H. G. Coffey heads the company's third operating group as Vice-President and General Manager of the Aetna-Standard Division.

Read Elected Executive VP of Cenco

Election of **Ralph C. Read** as executive vice president of Cenco Instruments Corp., and its subsidiary, Central Scientific Company, was announced recently by **John T. Gossett**, board chairman of Cenco.

Ralph C. Read

Frank S. Sheppard

Frank S. Sheppard has been promoted to Atkins Hardware sales manager, it was announced recently by **Robert V. Merrell**, general sales manager of Atkins Saw Division, Borg-Warner Corporation, Indianapolis. Sheppard started with the Atkins organization in 1917.

Michigan Tool Enters Gear Grinding Field

Acquisition by **Michigan Tool Company**, Detroit, of the assets of **Gear Grinding Machine Company** relating to gear grinding machines and processes has been announced by **M. R. Anderson**, president of Michigan Tool.

At the same time, Anderson announced the establishment of a new Gear Grinding Machines Division with headquarters at 7171 E. McNichols Road, Detroit 12.

All previous activities relating to gear grinding at Gear Grinding Machine Company are being continued by Michigan Tool without interruption.

Pressure Blast Buys Leiman's Sand Blast Equipment Division

Pressure Blast Mfg. Co., Inc. of Manchester, Conn., has purchased **The Sand Blast Equipment Division** of Leiman Bros. Co., Inc., Newark, N.J. The sale includes all rights, patents, tooling and inventory.

Mrs. Helen McMullen, general manager of Pressure Blast, says that the transfer of physical inventory from Newark to Manchester has been completed and that production of equipment at the new site is underway.

Wheelabrator Corporation Adds New Subsidiary

Wheelabrator Corporation has acquired **Lake Erie Machinery Corporation** of Buffalo, N.Y., according to **J. F. Connaughton** president of the Indiana firm. Lake Erie Machinery will operate as a wholly-owned subsidiary.

Elmer A. Rich. III has been named vice president and general manager for the Buffalo company. **Robert E. Dillon**, its former president, has retired, but will serve in a consulting capacity.

Micromatic Adds Grinding Machine Line

Micromatic Hone Corporation is now the exclusive sales and service source in the United States and Canada for grinding machines manufactured by its associate, A. A. Jones & Shipman of Leicester, England. Jones-Shipman has been building and selling Micromatic equipment overseas since 1950.

Disogrin Industries Realigns Sales Organization

Due to its rapid growth and attempts to keep its sales department facilities apace with this expansion, Disogrin Industries, Inc., Mt. Vernon, N.Y., announced the creation of two separate and distinct sales divisions.

The Disowheel Division, managed by Joseph A. Gagen, will be responsible for the sales of Disowheel and the servicing of Disowheel customers. The other division, the Disogrin Products Division, headed by Kenneth H. Grim, will be in control of all applications and sales of Disogrin products other than Disowheel.

New Rivett Distributor

Rivett, Incorporated, of Boston, Mass., has appointed **Kerns-Morrell Company**, 9140 Charlevoix Ave., Detroit, Michigan, as exclusive distributor in the Detroit area for Rivett air and hydraulic valves, cylinders and power units.

Moreland Expands Plant

The Moreland Corp., a large manufacturer of printing and industrial rollers in the United States, has enlarged its Willow Grove, Pa., plant by nearly 30%.

The expansion made possible a new highly efficient materials handling system with separate dock facilities for receiving and shipping. The offices have been renovated and a new, separate production control office installed.

Raybestos-Manhattan Expands

Raybestos-Manhattan, Inc., has contracted with William F. Lotz, Inc., Philadelphia engineering and construction firm, for expansion of its Wabash Division plant in Crawfordsville, Indiana.

The addition, 30,000 square feet, is the second to the plant originally built in 1951. It is part of a planned expansion based on the original design, and is scheduled for completion in October.

4 sweet solutions for faster grinding action

For 1¢ a gallon of coolant, you get the most open grinding wheel you'll ever see, with W&B Grinding Concentrate 1500 — unusually keen grinding action. White & Bagley's 1500 is a chemical type water soluble that mixes instantly with water. It forms a light-green, transparent, non-irritating solution that stays sweet and clear. Use it for exceptional accuracy, high production, on *steel and titanium.*

When you want keener grinding action on *steel, cast iron and nonferrous* metals, use W&B Grinding Concentrate E-55. It forms a light-green, transparent solution that retains clarity, — won't irritate skin — eliminates foul odors.

Both E-55 and 1500 (above) give you excellent rust protection, settle chips fast, leave parts and machines clean — they're the best chemical type concentrates you'll find.

To get superior results on *both grinding and cutting,* use W&B Lubricant 1888. This oil-type, water soluble concentrate with high-detergent action mixes easily with any water — forms a stable translucent emulsion that gives more support to wheels and cutting tools. You get smoother finishes, and closer tolerances with White & Bagley's 1888. It's non-irritating, free from offensive odors; keeps machines clean.

If you want to replace oil on tough grinding and cutting jobs, try W&B HD Soluble 2213. It's an all-purpose, extreme-pressure concentrate — fully miscible with water. Gives more support than other water solubles, plus excellent cooling. White & Bagley's 2213 in water produces better results than many cutting oils. It's nonirritating, resistant to odor formation.

To get a sweet solution for any grinding problem — write The White & Bagley Co., 88 Foster St., Worcester, Mass.

W-B INDUSTRIAL LUBRICANTS

THE WHITE & BAGLEY CO.

Worcester, Massachusetts · Detroit, Michigan

Originators of Grinding Lubricants

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NEW WAY TO REDUCE GRINDING TIME-&-COST

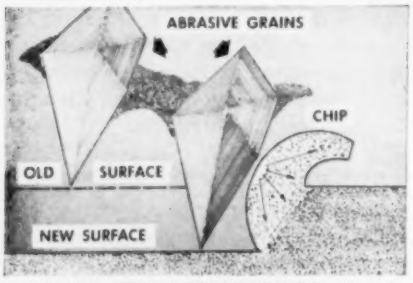
Wheel was treated by dipping into KGP's new "Dri-Kool". Cost was about a dollar—RESULTS:

1. Saved $5.40 in wheel life (wheel cost $18).

2. Got 30% more cutting action between dressings and grinding was faster.

3. TIME SAVED ON THIS JOB, NINE MAN HOURS.

SOURCE: Time-study reports of a triple-A Detroit cutting tool manufacturer, dry grinding M-3 H. S. S. with vitrified bonded wheels.



WHAT'S BEEN HAPPENING: Localized frictional heat melts the chip. Molten metal fills the pores. *The Wheel is loaded.* IN DRI-KOOL TREATED WHEELS, all pore surfaces are coated with a thermal-conductive parting medium. Heat is transferred throughout the wheel, radiating off all its surfaces.

REPORTS FROM USERS SHOW: High speed steels are now being ground *burn-free* and *burr-free* for the first time . . . Micro-finishes are improved on hard abrasive-resistance metals . . . Tool manufacturers have said, "We're now able to assure our customers longer tool life."

Impregnating with KGP's DRI-KOOL takes five minutes followed by a drying period. This one treatment lasts for the life of any vitrified bonded wheel. It won't wash out—and the dynamic balance is unaffected.

TO TEST DRI-KOOL IMMEDIATELY—order one gallon (enough for six 14-inch wheels) at KGP's introductory price of $7 (parcel post paid); or five gallons at $30 (FOB Trenton). King Graphite Products, Inc., 21945 Telegraph Road, Trenton, Mich.

INQUIRIES INVITED from Manufacturers Agents and Industrial Distributors

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NEWS OF INDUSTRY *continued*

Norton Promotes Sales Executives

Robert Cushman has been appointed general sales manager of Norton Company's Abrasive Division. **W. Alex McCune** succeeds Cushman as sales manager of grinding wheels.

Harlan T. Pierpont has been appointed sales manager of abrasives, succeeding **George A. Park**, who retired October 1st, after a Norton career of 50 years.

William A. Russell, formerly Detroit district manager, returns to the Worcester, Mass., office to assume McCune's former post as manager of field sales, grinding wheels. **David H. Paul**, formerly an abrasive engineer in the Baltimore area has been named district manager at Detroit.

R. Cushman

W. A. McCune

H. T. Pierpont

W. A. Russell

D. H. Paul

J. W. H. Conklin

James H. W. Conklin has been named General Sales Manager of Pratt & Whitney Co., Inc., West Hartford, Conn.

revolutionary

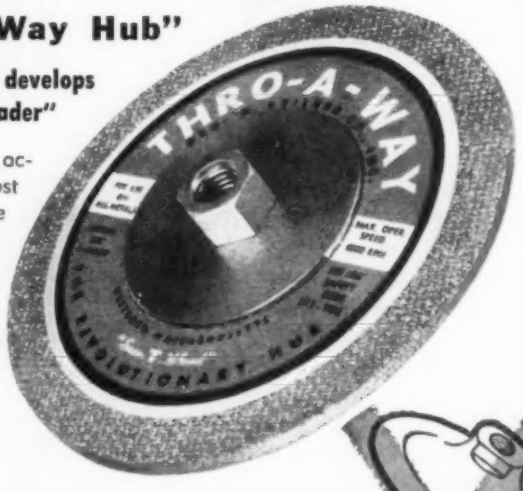
the "Throw-A-Way Hub"

The birth of an "idea" develops into an unchallenged "leader"

A design and construction accomplishment that insures cost reduction to small and large users — Performance outstanding.

The "Thro-A-Way" is **safer — more rugged — faster.** Only one specification manufactured for metal removal. No inventory "build up problems".

For use on all right-angle grinders pneumatic or electric. Withstands greater peripheral speeds.



ELIMINATES:

Geo. H. Bullard

COMPANY INCORPORATED

ABRASIVE PRODUCTS WESTBORO, MASS.

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Low-Cost Abrasive Cutting at 41st Metals Exposition

The techniques and apparatus employed to obtain the full benefits of high-speed abrasive cutting at lowest cost were featured by **Allison-Campbell Division, American Chain & Cable Company, Inc.,** at the 41st National Metal Exposition in Chicago.

Two high-capacity abrasive cutting units, one a dry type introduced to the trade at the show, the other designed for wet use, were in operation.

New Campbellene, a chemical coolant concentrate, was also featured.

Also included in the display were Allison abrasive cutoff wheels up to 34" in diameter and capable of cutting through steel billets up to 12" x 12".

Armour Patents No-Load Coated Abrasive

United States Patent number 2,893,-854 has been granted to the **Coated Abrasives Division, Armour Alliance Industries,** Alliance, Ohio, for its No-Load products.

The special coating applied to the abrasive surface of the paper will not contaminate the surface nor rub off during normal use.

Heald Names Lockwood R & D Manager

George H. Lockwood has been appointed manager of research and development for The Heald Machine Company, according to an announcement by **A. Frances Townsend,** vice president in charge of engineering. He had been supervisor of grinding engineering.

G. H. Lockwood

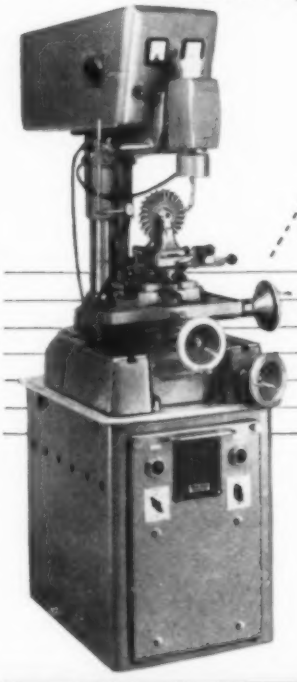
K. A. Hill

Besly-Welles Names Hill Chief Engineer

Keith A. Hill has been appointed chief engineer, new product development, for the Besly-Welles Corporation, South Beloit, Illinois.

Hill and **R. A. Kemman,** sales manager, Grinder Division, recently shared the Mechanix Illustrated award for amateur-built aircraft, for a design for a one-man helicopter.

Like to increase your cutting tool life up to 400% ?



Examples of increased tool life

Turning Tool, Single Point	250%
Spot Facing Tool	200%
Slitting Saw, 60 Teeth	400%
Punch and Die	300%
Reamer, 6 Flutes	50%
End Mill, 2 Flutes	75%

Ask for 12 page bulletin "Sparcard"

Hardness and wear resistance of tungsten carbide are combined with toughness and resilience of high speed steel.

New Sparcard machine deposits and bonds carbide on tool surface by electrical discharge.

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DRESS ABRASIVE BELTS FOR 30% LONGER LIFE

Unique Desmond Beltbrasive® dressers increase abrasive belt life 30% or more . . . give you "new" surface efficiency throughout belt life. Patented dresser quickly cleans out loaded belts, drums or discs on metal, wood or plastic jobs. One light pass when belt begins to load is all you need. Typical model costs less than $7. Ask your Desmond distributor.

The only complete line of grinding wheel dressers and cutters

Desmond

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the finest for geometric forms

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- EXTRA LARGE RANGE
- ONE MINUTE ANGULAR SETTINGS
- STRAIGHT LINE DRESSING

Note:
For Unlimited Contour Dressing on any machine Write for "CONTOUR REX" Brochure No. 1

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New
RAMPE 30 x 48

cuts big-job finishing costs

Real cost-saving is only part of the story with this newest, most productive Rampe machine. In 30 x 32 or 30 x 48 sizes, with one to three compartments, it gives you broad usefulness, simple operation, and the rugged dependability recognized in all Rampe precision finishers. Variable speed drive 8 to 25 rpm, "No-Seam" vinyl-lined barrels, and a wide selection of control accessories give real flexibility. Find out how you can cut costs . . .

write for details on Model 30x32 or 30x48 today.

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NEWS OF INDUSTRY *continued*

Gallmeyer & Livingston Head Dies

W. H. Gallmeyer

William H. Gallmeyer, 76, president and treasurer of Gallmeyer & Livingston Co., Grand Rapids, Michigan, died of a heart attack at his summer home

He had been president of the company since 1948, succeeding his father, who headed the firm from its beginning until 1932, and his brother, president from 1932 until 1948.

Sheffield VP, Director Dies

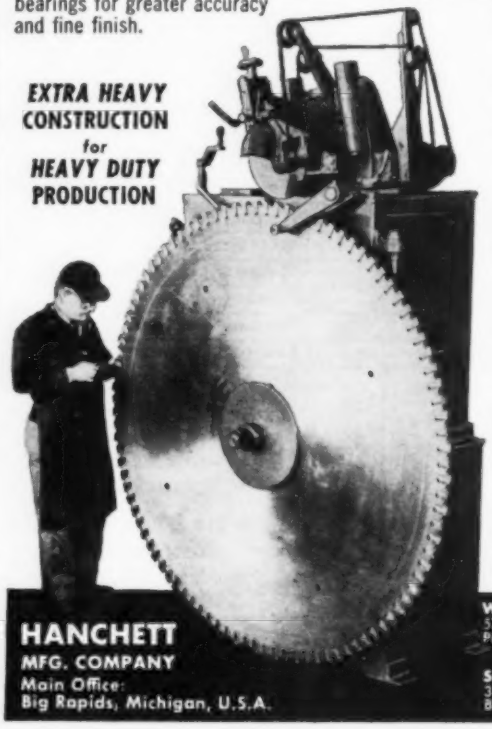
C. H. Reynolds

Charles Herman Reynolds, retired vice president and former member of the board of directors of The Sheffield Corporation, a subsidiary of Bendix Aviation Corporation, died recently of a heart attack at Brutus, Michigan, where he had lived for the past few years. He was 68.

HEAVY DUTY GRINDER SHARPENS METAL CUTTING SAWS TO 84" DIA.

For large Diameter Saws of all types, Inserted tooth, Segmental or solid tooth. Adjustable to wide variety of tooth spacings. Extremely heavy duty Construction Ball and Roller bearing throughout. Saw teeth generated by cam control. Adjustable by means of conveniently placed hand wheels to wide range of tooth spacings and depth of saw teeth. Saw is carried on heavy duty roller bearings for greater accuracy and fine finish.

EXTRA HEAVY CONSTRUCTION for HEAVY DUTY PRODUCTION



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Plan for Standard Terms in Industrial Brush Processes

The Industrial Brush Division of the American Brush Manufacturers Association at a recent meeting in Worcester, Mass., laid plans for the development of standard nomenclature for various types of brushes. Also discussed at the meeting was a promotional campaign designed to show the advantages of industrial brushing processes.

The meeting was set up by V. F. Miller, of The Mill-Rose Company, Cleveland.

Other companies represented were: Weiler Brush Co., The Fuller Brush Co., Anderson Corp., Dixon & Rippel, Inc., Braun Brush Co., M. W. Jenkins' Sons, Inc., Mason-Worcester Brush Co.

Also Woonsocket Brush Co., Spiral Brushes, Inc., Pittsburgh Plate Glass Co., Gus Reidel & Son, Inc., Newark Brush Co., Schaefer Brush Mfg. Co. Inc., Brushes, Inc., Malish Brush & Specialty Co., and Better Brushes, Inc.

Louis V. Abrams, recently employed in management consultant work, has joined Pangborn Corp., Hagerstown, Md., in the newly created post of Administrative Assistant to the President.

New GM for Carbo's Curtis Machine Division

Carl B. Wille, formerly director of engineering for The Carborundum Company, has been promoted to general manager of the company's Curtis Machine Division, according to an announcement by **Clinton F. Robinson,** president of the company.

Wille succeeds **Gene DeMambro,** who resigned to pursue other business interests.

Straka Heads Carbo's Ceramic Fiber Project

Robert C. Straka, Jr., formerly manager of specialty product engineering for Carborundum's Refractories Division, has been promoted to manager of the fast-growing Ceramic Fiber Project, according to an announcement by **General Leslie E. Simon,** vice president and director of research and development for The Carborundum Company.

Fiberfrax® ceramic fiber is a lightweight, high-temperature insulating material which withstands temperatures up to 3200° F.

Any and Every DIAMOND TOOL... you name it, CLIPPER makes it!

- Single-pointed diamond wheel dressers
- Cluster-type diamond wheel dressers
- Diamond-impregnated wheel dressers
- Thread grinding tools
- Special-shaped diamond tools for turning and boring
- Diamond tools for radius dressing and radius forming
- Also outstanding selection of diamond wheels and hones

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FEEDCISION

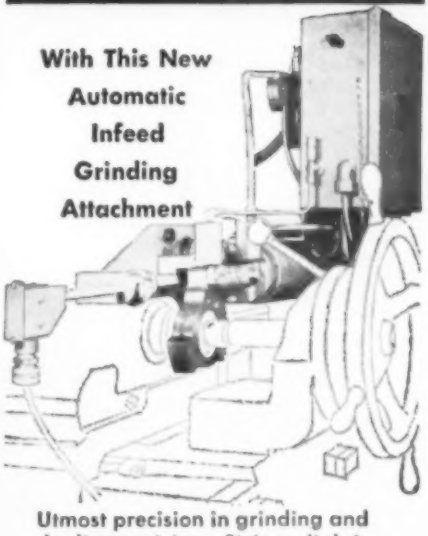
INCREASES CENTERLESS GRINDING PRODUCTION

200%

YES

300%

With This New Automatic Infeed Grinding Attachment



Utmost precision in grinding and duplicate sizing. Sizing dial is graduated in (.00001) one hundredth of a thousandth of an inch. No hydraulic checking cylinder to change feed rate when oil is cold. No checking of oil level or refilling of hydraulic checking cylinder. Three (3) different feed rates are available in one unit for the fastest, most efficient, and precise sizing in a centerless grinder.

CAN BE USED FOR TRU-FEED AS WELL AS INFEED for close sizing. Ideally located push button control station consists of Stop-Button, Caution Pilot Light, and a selector switch for set up or auto grinding positions. **CATALOG** — Write for it today!

MODERN DEVICES

Subsidiary of
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CRAFTS

complete catalogue of DIAMOND DRESSERS for every need

Now ready for you—CRAFTS catalogue of diamond dressers for every need and use. Full prices, specifications and information about re-setting on the famous CRAFTS line. Information too about our inexpensive "Letter Series" of tools. CRAFTS continuous research and job testing provide you with more economical ways to increased production. Always dependable, CRAFTS service reduces costly delays — minimizes downtime.

Mail this coupon for your free Diamond Dresser catalog.

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NAME_____

TITLE_____

FIRM_____

ADDRESS_____

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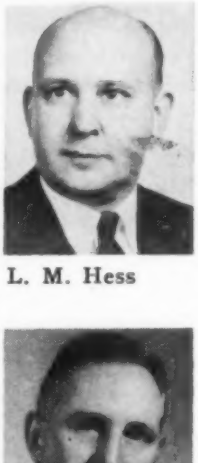
NEWS OF INDUSTRY *continued*

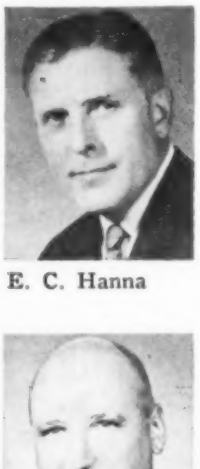
Landis Machine Promotes Four Executives

Leslie M. Hess, former treasurer and assistant controller of Landis machine Company, Waynesboro, Pa., was recently elected vice president and general manager of the company. His duties as treasurer were assumed by **H. L. Steck,** former controller, who was named controller-treasurer.

At the same time, **E. C. Hanna,** former chief research engineer, was chosen for the new post of director of engineering. **George W. Lyman** becomes the new chief research engineer.



L. M. Hess



E. C. Hanna

G. W. Lyman

G. F. Burns

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The man qualifying for this position must have a sound knowledge of the Powder Metal Industry and its tooling practice. We envision this man as a working leader of a group producing tooling with wide responsibility for method and manufacturing techniques.

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Surface Grinder 50 x 14 Brown & Sharpe Magnetic table, Belt Driven. Bargain. Good condition.

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Black & Decker Announces District Manager Shifts

Several changes in district managerial responsibilities have been recently announced by **R. G. Horner,** vice president—marketing for Black & Decker.

Jay T. Redmon has been shifted to Cincinnati as district manager of the Industrial-Automotive Sales Division, replacing **Ernest E. Randle,** now sales manager of the company's Canadian subsidiary. Redmon will continue to handle part of his former Indianapolis district; the rest will be under **R. L. Mick,** St. Louis.

M. Scott Rolston, formerly Minneapolis manager of the IA division, goes to Chicago, replacing **H. L. Bullock,** who resigned. **Paul J. Gagliano** succeeds Rolston.

Machine Tools Sales Manager Selected by Van Norman

The promotion of **George F. Burns** to the post of sales manager, machine tools, for the Van Norman Machine Co. was announced recently by **Selby F. Greer,** executive vice president.

Burns joined Van Norman, a division of Van Norman Industries, Inc., in 1939.

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California's World-Famous Resort overlooking the Blue Pacific where Wilshire meets the sea. Twenty minutes from International Airport. 450 luxurious rooms and bungalows, all with television and radio. Complete convention facilities. Banquet rooms for up to 2,000, air-conditioned. Exciting new Venetian Room and Cantonese Room. Swimming pool. Beautiful grounds and landscaped gardens. Rates from $8. Write William W. Donnelly, Gen. Mgr.

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World-famed hotels
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Woodworth Names Sales Rep

Appointment of **Robert M. Diedrich** as sales and service representative for the N. A. Woodworth Company has been announced by **R. W. Chadwick**, vice president in charge of sales. Diedrich has joined the staff of the R. H. Thompson Company, representatives for Woodworth in the Dayton and Columbus, Ohio, area.

Woodworth, 1300 East Nine Mile Road, Detroit, is one of industry's major suppliers of work-holding devices.

R. M. Diedrich

Rollway Bearing VP Resumes Duties

H. Follett Hodgkins, Jr., is returning to his position as vice president of Rollway Bearing Company, Inc., Syracuse, New York, after a year's study of advanced management techniques and procedures under a Sloan fellowship at Massachusetts Institute of Technology.

H. F. Hodgkins

Stevenson Is Michigan Rep of Vitrified Wheel

W. J. Stevenson has been selected as Michigan representative of Vitrified Wheel Company, Westfield, Mass., it was announced by **E. F. Mitchell**, vice president.

Vitrified Wheel manufacturers resinoid, vitrified and shellac grinding wheels.

W. J. Stevenson

Appointment of **Edward C. McFadden** as sales engineer for the West Coast Branch Office of Bendix Filter Division of Bendix Aviation Corporation is announced by **F. C. Weyburne**, general manager of the division.

E. C. McFadden

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Our reclaiming department salvages diamond powders from wheels, sludges, hones, saw blades, cotton wastes or any type of diamond bearing material. We will submit quotations on an analysis basis.

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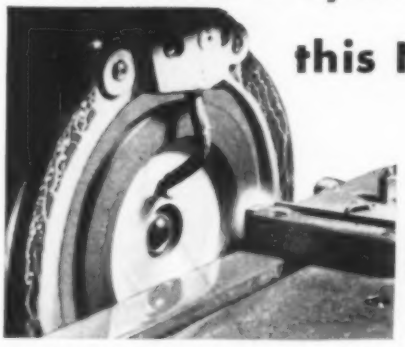

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ELECTROLYTIC GRINDING

The exclusive "E-2" bond in A.I.T. diamond wheels has been developed specifically to guarantee that you get the FULL VALUE out of Electrolytic grinding of carbides. We can prove this in YOUR plant, on YOUR grinders, with these results:

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NEWS OF INDUSTRY *continued*

Precision Disc Grinding Opens West Coast Branch

Precision Disc Grinding Corp., 255 East 2nd Street, Mineola, N.Y., contract grinding firm, announces the establishment of a West Coast division under the name of Precision Disc Grinding of Calif., Inc.

The new division, located at 1044 West Hillcrest Blvd., Inglewood, Calif., will serve the needs of the West Coast in double disc grinding, flat lapping and other machining services.

The Fuller Merriam Co., West Haven, Conn., has appointed the **W. P. Younger Co.**, Charlotte, N.C., as its representative in the three-state area of Va., N.C., and S.C.

Universal Grinding Expands New Plant

The Universal Grinding Corporation, 2200 Scranton Road, Cleveland, Ohio, in its second major expansion in the past year, is erecting a 27,000 sq. ft. addition adjacent to its present plant, acquired in 1958.

The company presently has 95 production grinding machines, will add 25 units when the plant addition is finished.

For cut-off of reinforced plastics, ceramics, carbides and glass. Ideal for wafering of large diameter Germanium and Silicon Solar Discs.

NOW AVAILABLE — diamond saws especially designed for cut-off and machining of reinforced plastics. Precision cut-off wheels for semi-conductor production — made in Thicknesses down to .004"

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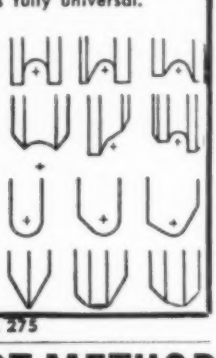

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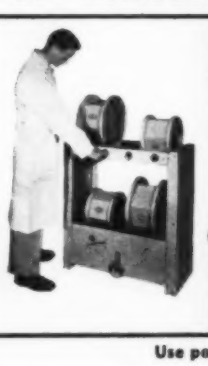

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GRINDING and FINISHING

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46 Accurate Shop Testing of Diamond Wheels
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47 Gages for Volume Production; Ultrasonic and Optical Gaging
Concluding article of four-part series. Electrical and electronic gaging for in-process and post-process applications, together with gaging by light or sound waves.

Coming Next Month

Standard Time Data for Grinding

Starting a series which will cover standard time data as they apply to surface, cylindrical, centerless, tool and rough grinding operations. This is a revision of the series which ran in the 1957 issues of GRINDING and FINISHING.

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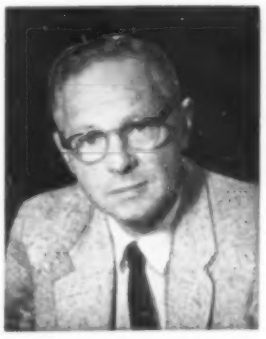
A Final Thought

Partial Answer to the Import Problem

The realization that we are losing our overseas markets and that foreign imports are cutting into our domestic markets is unpleasant. That Russia has outdistanced us in rockets and missiles is equally as offensive. That our gold reserves are being depleted and that dollars are flowing out of the country faster than they are returning should cause concern. In addition to this gloom, we are pricing ourselves out of the world market and, in some instances, out of the domestic market. These are bitter pills to swallow, and yet they are not half as sickening as the fact that we are doing very little about the taste of the pill. As a matter of record, the government is sending some $4 billions out of the country each year and is furthermore encouraging us to invest abroad as heavily as we can. This is a further drain the once stable dollar. However, this phase of the problem is for financial wizards and not for the likes of us who can't even balance our monthly checkbooks!



What about imports? Some industries are not yet suffering under the yoke of foreign goods with their annihilating price differential; others, like the watch industry, have been crushed under the load. The only way to meet this competition is to be competitive. Let's give 'em a run for their money. We must get our feet apart and spit on our hands. There are no simple palliatives. For the last 25 years business has tried to do things with the help of the government. Too many business people have looked for ready-made answers, for the easy way of doing things. Is this the much vaunted American tradition? Or are we possibly seeing the birth of a new tradition: the tradition of the handout and the easy way?

Many intelligent business brains have struggled over the import problem and the need for a competitive position in world markets. So far they have not struck a light in the forest to show the way. And so we wonder if the answer does not lie underfoot, that it need not be hunted in forests and mountains. Should not the solution be looked for in part, in people and productivity? That means the workers, supervisors, managers and salesmen and everybody else connected with the company. The problem can be attacked and be on the road to a solution if everyone worked 25% harder during the coming year with no increase in wages, and no increase in company profits and a drastic product price reduction based on this increased productivity factor. A profit sharing program could be worked out for the benefit of everyone who participates in the program. And we say bluntly that there is no one who cannot work 25% more a year in the same allotted time he now has.

You might well say that there are other factors to be considered. Agreed! Many, many things must be considered, but are we making a start on any of them? Shouldn't we start with people, with you and me and our colleagues? You might also say we are dreamers and that there are other answers. Probably, but so far no one has come with the easy and painless answer, and you know and we know that nobody will. You might say, quite bluntly, "It can't be done." And that's probably where we differ. We don't know it can't be done. All we know is that the Germans have done it and the Russians are doing it!

Wm. J. Schleicher

Vice President & Editorial Director

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and just look at all these features:

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- Greased-for-life precision ball bearing spindle with two speeds for long wheel life
- Equipped with Vickers vane type pump and our own control valve for infinite longitudinal table speeds from 5″ to 120′ per minute
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No. 350 PRECISION TOOL ROOM TYPE HYDRAULIC FEED SURFACE GRINDER

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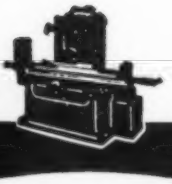

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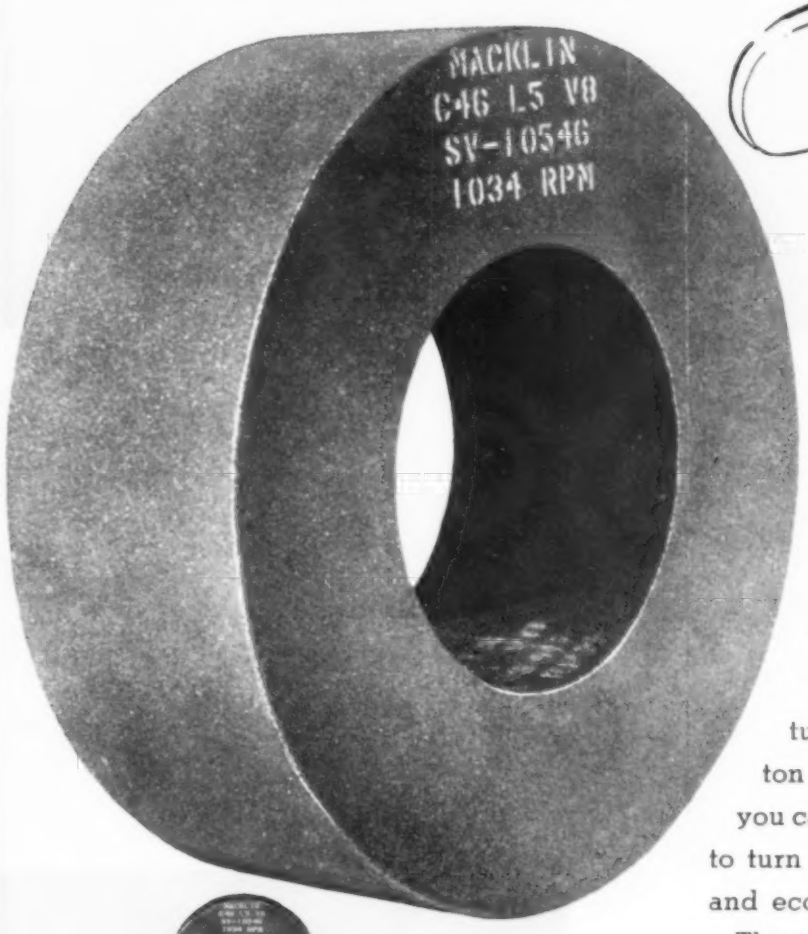
"Wheels of Profit"

by MACKLIN



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for uniform, HIGH SPEED PRODUCTION

Whether you finish bolts, bars, rods or tubes . . . bearings, tappets, pistons or piston rings . . . twist drills or plastic parts . . . you can depend on Macklin centerless wheels to turn out *identically* ground pieces quickly and economically.

They cut cool and sharp. They have good balance. Uniform dispersion of abrasive grain through the wheel enables you to hold part size uniformly and to obtain good finish.

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ROUGH GRIND PINION SHAFT "Good stock removal. Finish excellent. Have standardized on this wheel." 20x6x12 C60 L5 V8

FINISH HIGH SPEED CARBON DRILLS "Wheel very satisfactory. Production increased materially." 20x8x12 18A 100 N5 V6

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MACKLIN company

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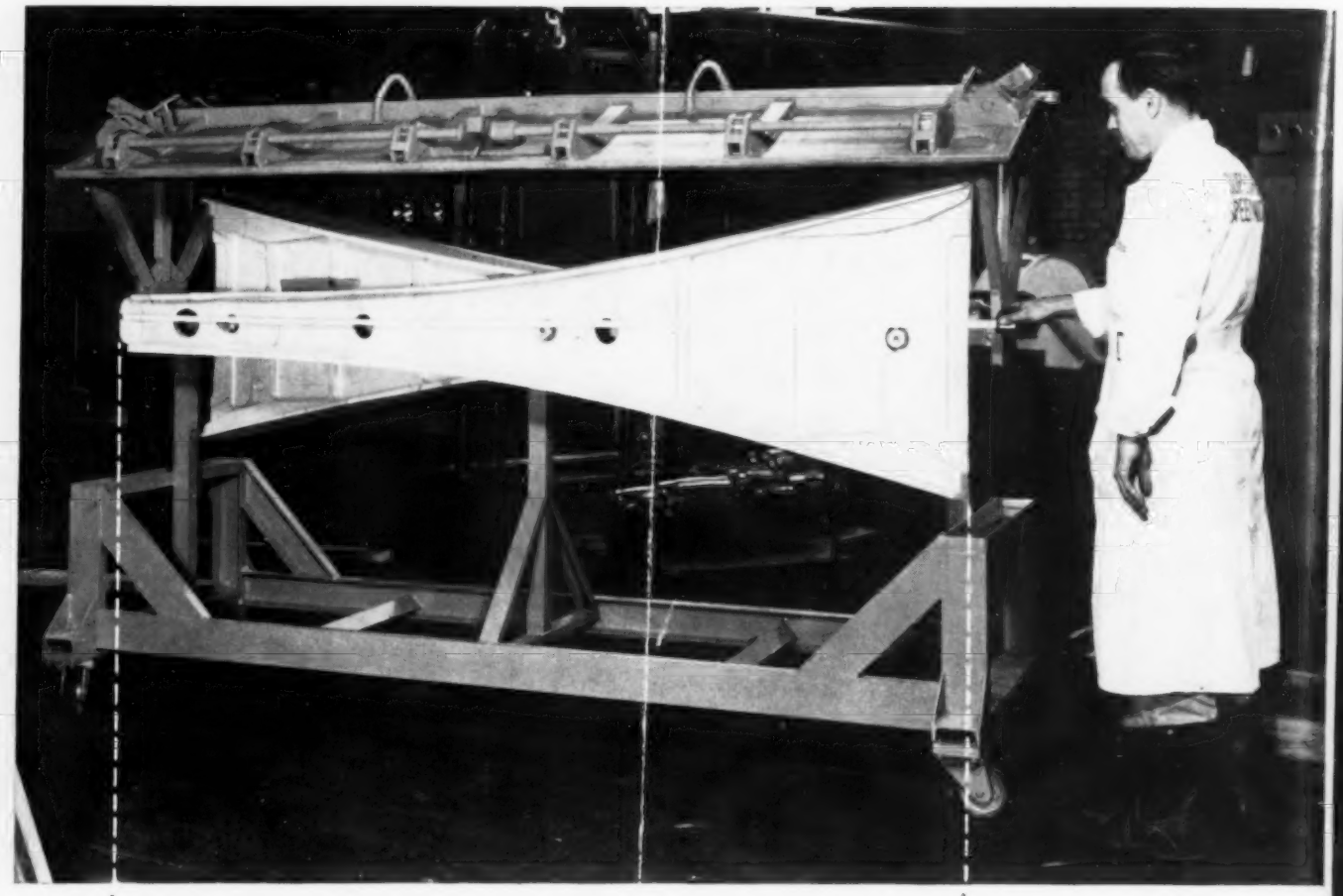

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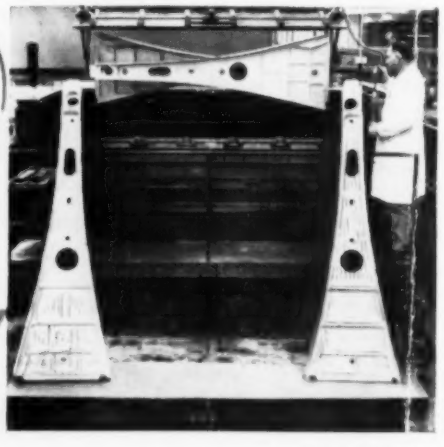
SUPERIOR MACHINES AND METHODS FOR FINER BARREL FINISHING.

YES! With ALMCO's efficient, versatile barrel finishing equipment, the 93 inch wing spar above was finished in a two hour time cycle. Thirty inches long at the wide end and 8 inches thick, the spars are finished two at a time in a special ALMCO unit at McDonnell Aircraft Corp., St. Louis, Missouri. Previous hand methods required many additional hours of finishing time and it was difficult to maintain uniformity of the parts.

These aircraft wing spars are barrel finished to blend in radii and improve micro-inch finish on other surfaces through use of ALMCO Supersheen media and burnishing compounds. All surfaces receive the same treatment—rejects due to imperfect finishing are eliminated. Tremendous labor savings are made by using ALMCO's modern barrel finishing methods.

ALMCO's modern machines and methods—the Supersheen System—may help you achieve vital costs savings too. At ALMCO you receive trained counsel for your finishing problems . . . *free* sample processing in ALMCO's modern labs . . . skilled guidance in selecting the proper standard or custom-designed ALMCO machines and methods. Write today on your letterhead asking for an ALMCO sales engineer to call. Or send parts direct to ALMCO's lab with specs required.

Note "machining ridges" on foreground spars, prior to Almco Barrel Finishing. Supersheen Aluminum Oxide chips with Almco #10 compound are used in 2 hour finishing cycle.



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